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THE AMERICAN JOURNAL OF PHARMACY.

APRIL, 1842.

ART. I.—INTRODUCTORY LECTURE DELIVERED AT THE COLLEGE OF PHARMACY, NOVEMBER 4, 1841. By WILLIAM R. FISHER, M. D., Professor of General and Pharmaceutic Chemistry.

GENTLEMEN,—The relative positions which we occupy on the present occasion,—yourselves as seekers after knowledge, and he who addresses you as placed here to impart it,—demand a cautious and deliberate consideration; and invite on the part of either, a respectful esteem and sincere confidence from each toward the other. It is an occasion possessing high interest for both parties. It is a period towards which you have looked for some time as pregnant with certain benefits; as abounding with valuable information; as the attainment of such a position in the course of your studies, as promises, with a faithful attention and assiduous industry, to yield an earnest of your future usefulness and prosperity. To some of you the termination of the present course bears prospects of the successful conclusion of your studies, and the commencement of an honorable career as proficients in your profession; while others there are who now enter, for the first time, these walls, in search of those truths of which the more advanced are already partly in possession. Eager for the achievement and zealous in the pursuit, the occasion possesses no less interest for the less than for the more advanced student; though feelings and motives of a somewhat different character are experienced by both. In both, however, the feelings are generous

and commendable; the motives praiseworthy and noble; your ambition such as becomes you; and your condition full of in terest and sympathy. Confiding in the wisdom and experience of those to whom the duty of providing you instructors is committed, you assemble at their call to listen to the accents, and follow the counsels; to regard the advice and drink in the instruction of one almost an entire stranger, whose opportunities for presenting any evidence of his claims to such confidence have been few; and whose whole title to your attention, as yet, rests upon your regard for the opinions of your elders. If such be your feelings and position, and a candid self-examination is appealed to for the accuracy of the portraiture, are we not justified in regarding the occasion as filled with interest for you in its hopes and prospects, its trusts and responsibilities? But, serious as are your reflections, and anxious as your hopes, no less are those which press upon the future conductor of your journey—upon him to whom so much of your welfare is committed. But a few short years have elapsed since he occupied the very ground which you now occupy, and listened to those principles, which it has now become his duty to teach. The partiality of those from whom he receives his commission has elevated him to this responsible station, and invested him with a power fraught with evil or good, as he may employ it. The highest confidence has been placed in his attainments and character; and the reputation of the College, to say nothing of his own reputation, is placed at stake, to be almost irretrievably blasted should he fail to discharge, as in duty bound, the obligations which he is under to it, to its representatives, and to you. Coming, then, before you for the first time in his new obligations to you and the College, deeply impressed with the value of the trust which has been put in him, subjected to the scrutiny and comparison which invariably attend the inauguration of a new teacher, and entertaining no exalted estimate of his his attainments, can he be otherwise than sensibly affected by the peculiarity of his position, and the arrival of that period which is to witness his induction into this chair as the Professor of Chemistry in the Philadelphia College of Pharmacy—a

chair to which he succeeds under circumstances peculiarly trying to one almost a novice? He is about to be placed in direct apposition with predecessors eminent for their attainments; distinguished for their intellectual endowments. Comparisons are to be instituted between their professional abilities and his own; and the experience of many years will be brought into competition with the brief practice of a beginner.

A successor is now about to take the place which has been occupied by those who have been called away to vaster fields of labor; whose merits and established character have been rewarded by those distinctions and preferments which their services most justly have deserved, and who are now classed among the worthies of our land, in the front rank of professional eminence. Names, whose invariable association recall to our recollection the valued services which they have rendered to Pharmacy, and especially to this school, decorate the chair into which an untried occupant is this day about to take his seat.* Possessing the least sensibility, should he not hesitate at the threshold, ponder deeply the responsibility, and make the first entrance with sincere diffidence as to the result? Can such an occasion be then destitute of interest, or regarded as a mere ordinary assemblage for a public discourse? Sensible of all these momentous responsibilities, and the relation in which he stands to the College, to you, and those who have preceded him; feeling that on all accounts he is bound to see that no retrograde movement shall ensue in any matter committed to his charge, the new incumbent assumes the chair with his best exertions pledged to prosecute the undertaking with which he has been entrusted by the partiality of the officers of the College. His own early professional character, identified in some measure with that of the College as one of her alumni; his future professional rank depending upon the fidelity and ability with which he shall discharge his duty to you; his personal relation with, and the high estimation in which he holds the reputation of his predecessors, all concur to stimulate his

* Professor Wood, University of Pennsylvania; Professor Bache, Jefferson Medical College.

every effort to maintain the character and advance the interests of every class committed to his charge.

The length to which these personal remarks have been extended, by an anxious desire to expose the unaffected diffidence with which the assumption of this chair is attended, has, in some measure, directed your attention from an exposition of the plan of the course intended to be pursued. Without any assumption of originality in method or arrangement, it may fairly be allowed to every teacher of Chemistry to arrange his subjects in a manner peculiar to himself, according to his best judgment; and this, too, without any imputation against the propriety of the arrangement of others. There are, perhaps, no two minds in which the great system is seen in precisely the same point of view; and hence follows the difference in the mode in which its outline would be presented by each to others. Equally differing are the values which various teachers would place upon the same portions of the science; and hence it is that equal prominence is not given by all to the same subjects. Of the propriety and estimate which is to be placed upon each arrangement, and the confidence to which the selection of prominent topics is entitled, the results must determine. The time allotted for developing the truths of chemical science is by far too brief to enable the lecturer, concise and perspicuous as he may be, to introduce to the notice and attentive regard of his class all that is embraced within these terms. He is, therefore, compelled to make such a selection of topics as the period assigned will embrace, and to which a proper degree of attention may be paid. Although in certain respects all must agree, in regard to what may be deemed fundamental principles, which must, by all means, be included in any arrangement, yet, in descriptive Chemistry, some latitude is allowed for the exercise of individual judgment; and, hence it is, that teachers will differ in regard to the selection of topics toward which the mind of the student is to be directed, and upon which the attention is invited to dwell. Various motives must exist, in directing the judgment of the professor to the one hand or the other, as he enters upon the vast field from which his harvest is to

be gathered; and he may, perhaps, himself be insensible to the exact amount of influence which each may exert. But, be the value of other motives what they may, to none should be awarded so much deference and influence as a steady regard to the purpose to which the information, when acquired, is destined to be applied. When the length of the course will admit, too full and comprehensive an arrangement cannot be made; but limited as we are here in all the institutions in which the science is taught, it is impossible to include every thing which the science of Chemistry embraces.

Therefore it is, that a necessity for a selection of topics exists, and that we are compelled to divide and classify our science, as its disciples we are in pursuit of its truths, for one purpose or another. Hence it is, that we have "Chemistry applied to the Arts," "Agricultural Chemistry," "Organic Chemistry," "Pharmaceutic Chemistry," and we doubtless soon shall have "Physiological Chemistry," to judge from the valuable contributions to the science of life which have of late years resulted from industrious chemical research.

It is within one of these departments that our selections are confined; for, by the establishment of this chair, its duties are especially directed to Pharmaceutic Chemistry. General and Pharmaceutic Chemistry is the title by which the professorship is designated, indicating a wise provision on the part of its founders that the peculiar interests of those attending upon its lectures shall be constantly regarded. Thus, far, then, the judgment of the Professor is guided in his selections and arrangements; but there is yet need for the exercise of his discretion in calling from the extended field of Pharmaceutic Chemistry, subjects possessing the most value for the student of Pharmacy. Herein may be expected that difference of opinion to which reference has already been made, and wherein consists the contrast between different teachers, all exercising their best judgment, guided by the best lights within their reach. It is for the results depending upon this exercise of judgment, that they are answerable to the public, and by which they will be judged by those who

have opportunity and ability to reflect upon and examine their selection.

It will not be deemed a mere aspiring to originality and peculiarity, then, if the present course should differ in some respects from those which have preceded it; nor can it be hoped that much, if any, room be afforded for improvement upon former methods. The servile imitation of a contemporary, I feel assured, would not be expected or approved by any candid mind, and a sketch of the course with which it is designed that our time, during the approaching season, shall be occupied, is therefore submitted, with diffidence and deference, for the opinions of those who are competent and disposed to examine it. It is the result of cool and anxious reflection, aided by no trifling experience in the duties, wants, and resources of the apothecary, and a determination, so far as ability allows, to assist these duties, supply these wants, and develope these resources; presenting to the young student of Pharmaceutic Chemistry as complete and comprehensive a view of that branch of General Chemistry as the experience, resources or industry of his teacher can supply. If, upon comparison with other systems, it should be found that they coincide in many respects, the coincidence of independent judgments should be regarded as confirming the correctness of each; if, on the other hand, some difference of method be found to exist, it is to be hoped that it has arisen after a conscientious examination of the subject; is capable of being sustained by sound argument, or of reconciliation after further reflection. The assertion is reiterated in all honesty, that nothing has been introduced, withheld, or altered for the mere sake of novelty. That it will meet universal approbation cannot be looked for; that further experience will suggest modifications may most surely be anticipated; that every effort shall be made to render it perfect, is here solemnly pledged.

By the title of the chair already announced, you are led to expect a course of lectures on General and Pharmaceutic Chemistry; and it is to a cursory sketch of the plan to be pursued that your attention is now invited. General Chemistry may be defined to be the whole science embracing every prin-

ciple, and every detail which may be connected with the chemical properties of matter, organic or inorganic; the relations of its ultimate elements; the mutual action or reaction of them, the effect of their new combinations; and the study of the laws according to which the imponderable agents manifest their influence and exert their power.

This definition gives an increased sphere to the operations, and a vast limit to the extent of General Chemistry; so great, indeed, as almost entirely to preclude its accurate and complete grasp by any one mind. Its division or classification, therefore, has been found necessary; and the various departments into which it has been divided (already announced) have enlisted in their support and prosecution, votaries who pursue the objects of the particular branch to which taste or professional duties may have assigned them. In the latter condition do I find you now before me, who, to fulfil the requisites demanded by a thorough knowledge of your profession, and imposed upon those who aspire to the honors of this College, present yourselves to acquire the elements of Pharmaceutic Chemistry. A daughter of the general science, devoted expressly to the preparation of medicines, as exclusively as her sisters are occupied with the arts, with agriculture, and organic structure. In the study of each of these, a knowledge of the elements of General Chemistry is essential, and he who would teach either must commence his instruction with the study of these, if he hope to make the particular division at all intelligible. These are the fundamental principles upon which all chemical science is based, and an intimate acquaintance with them, therefore, is imperiously demanded. Without them your Pharmaceutic Chemistry would have none of the characteristics of a science, but would be mere empiricism; a catalogue of crude, unarranged facts; ill assorted, unclassified experience. Therefore it is, that you are required to have a knowledge of General Chemistry, its constituents, its laws, its objects.

The principles of General Chemistry, proposed to be taught here, are precisely the same as those usually introduced into a course of lectures on that subject. They embrace some

matters which are also included in lectures on Natural Philosophy, indeed, which may be said to hold an equal relation between these two portions of Natural Science; such are the doctrines of Specific Gravity, the laws of Caloric, Light and Electricity, in its different modes of manifestation, and a very brief sketch of the general properties of matter. These all form necessarily a portion of the course, although no more space is assigned to them than can possibly be spared. Of those doctrines, which are purely chemical, we have affinity in its varied phases; the doctrines of equivalent proportions; atomic theory; system and principles of nomenclature; and the use of chemical symbols, becoming daily ot greater importance from its almost universal employment. So far the subject matter of the course may be considered as General Chemistry, and will be limited as much as is consistent with justice to its importance and to the shortness of the time allotted us. And, although this portion of our subject will be necessarily much restricted, it is hoped that enough of detail will be practicable to render it sufficiently plain, and impress it distinctly on your minds. The character and relations of the electro-magnetic elements, as well as of those of simple combustibles, occupy necessarily prominent grounds, and after these the metals present important matter for study. Some insight into organic structure is alsoneeded, and in all these especial attention will be paid to those substances, which are most intimately connected with Pharmacy.

In regard to these, we have to consider the properties of those elements and their compounds, which are employed in medicine, or occupy space in the apothecary shop assigned them by long usage. We are to understand the chemical characters of the compounds, and the manipulations requisite for their production; we are to become familiar with the employment of re-agents, which will put into your possession means of detecting and exposing the fraud of the adulterator, or accidental impunity of the unskilful manipulator; we are to study, as of equal importance in the education of a pharmaceutist, the character of substances regarded poisonous, and the

means requisite to counteract their efforts; and in organic bodies there are certain proximate principles whose properties and relations are intimately connected with Pharmacy. From this sketch, slight as it is, it will be apparent that your attention will be limited to a consideration of those bodies simply, which, in some form, are connected with your particular profession. None but such can be described or discussed, however interesting the relation of others may be. The time allowed for the former class is even too brief to do them full justice, and will scarcely permit any especial devotion of it to processes and manipulations strictly pharmaceutical and wor thy particular study. All that can be introduced on these topics must attach incidentally to the bodies which are liable to be the subjects of them. To show the importance of these processes, and the need for instruction in regard to them, it is only necessary to enumerate distillation, the preparation of extracts, plasters, separation of proximate vegetable principles, and some of the manipulations employed in ordinary analysis. This is what, upon careful reflection, has been considered Pharmaceutic Chemistry: the examination and description of the chemical properties and relations of all substances employed in medicine; the study and application of such chemical operations as are used in the production of compounds, or needed for the separation of proximate principles. The construction which has been put upon the term Pharmaceutic Chemistry, and the plan of education here been based upon that construction, is thought to be entirely within the meaning and design of the founders of the College and the wants of the student. It is believed that no undue importance has been given to any portion of the subject, as just announced; nor has any matter of high interest been either suppressed altogether, or consigned to a subordinate position.

It seems scarcely necessary to state, in particular detail, the exact mode in which the principles here laid down will be carried out. Suffice it to say, that every effort and means of illustration, at all attainable, will be employed; and the chemical operations witnessed in the daily duties of the shop will be

referred to for demonstration. Personal experience and the records of our Journal, have shown the frequency of adulteration and debasement of chemical compounds used in medicine, and these it will be considered as the especial duty of this chair to expose. The value and dependance to be placed upon an exact knowledge of the specific gravity of liquid products, and the modes by which this information may be obtained, should also be taught and enforced. Thus, in general terms, is sketched out the plan of our course, so far as regards the distribution of scientific matter which is to constitute it, but it will not be deemed irrelevant, or considered unjustifiable, should such moral reflections be associated with the professional topics, as may thus be introduced, with advantage to the student. In accordance with this view, whatever opportunities may offer for sustaining the character and position which the Profession of Pharmacy should hold, will be promptly seized, and the effort be made to impress on the mind of the student the responsible and reputable rank which he is to hold in society, how much depends upon his probity, self-respect, conscientiousness and knowledge of his profession; and that now, in the morn of his life, are those seeds to be sown, those principles to be acquired, those habits fixed, which are to constitute his character in life, upon which his professional success depends. True it is, that ignorance and cunning may thrive for a time, and prevail over modest skill and intelligence; some adventitious circumstances may enable bold pretenders to attract public confidence, at the expense of diffident merit; ultimately, however, the real sterling professor of solid knowledge will secure the palm, and the daring pretender be thrown back in the race, his mask stripped from his features, and the emptiness of his professions exposed. But the success and eminence here promised are not to be the reward of indolence, nor the consequence of even faithful attendance upon a single course of lectures. Long, ardent, and well directed study must create the foundation upon which that character is o be built, destined to become the parent of usefulness and respectability in after life. Careful habits, strict system, re

spectful obedience, a deep sense of responsibility, and a determined purpose to regard your employer's interests as your own, are necessary to build up that name for accuracy, fidelity, and confidential trust which is equally required with a scientific reputation for your advancement. These, of course, are but the earthly means, which, blessed by the approbation of Heaven, will insure your success. That approval you are all apprised how to secure, and it is deemed no intrusion upon the duties of the sacred desk, and with no kind of irreverence is it spoken, that lasting prosperity cannot be expected, nor a sense of an approving conscience be enjoyed, unless recourse be had to that great source of excellence, the Giver of all good gifts, sought in the manner which he has directed. It is not my purpose, by the foregoing remarks, to forestall, anticipate, or interfere with the private counsel and personal advice which you may receive from those with whom yon are immediately connected, and to whom your direct responsibilities are due; nor will it be deemed an interference with their province thus to allude to subjects so much of a personal character. But, conceiving that, for a time, you have become pupils of the College, and that its appointed officers are those through whom alone its intercourse with you is sustained, and its interests and sympathies for your welfare expressed, it has been thought an especial duty thus to bring before you a sketch of the duties and qualifications which are required at your hands by your Alma Mater, the bountiful mother by whom so much of your intellectual nourishment is provided; she is interested in your welfare, concerned in the character which you may form. You are to reflect your excellence upon her; you are to carry her name wherever your own lot may be cast; you are to take part in the councils, and supply, eventually, the places of those who now oversee and direct her course. Can she then be indifferent to your forming characters, or withhold advice which she knows that those of your age and in your circumstances require? You are yet in her care, and by accepting you as her pupils, she has rendered herself responsible for your attainments. She, therefore, avails her-

self of the charge which she holds, to point out what the public will require of you, and to say that the award of her diploma does not depend solely upon a proficiency in study, but that good moral standing, sound principles of action, and inflexible honesty of purpose, are equally demanded of those who seek, at her hands, the evidence of merit and confidence. You must recollect that, ere many years elapse, into your charge will be committed the destinies of the College, the education of the rising generation, and the cherished reputation which Philadelphia Pharmacy is acquiring.

The invitation which has been extended to us to participate in the proceedings of the next convention for the revision of the National Pharmacopœa, renders still more imperative upon us the duty of qualifying our students, so that they may be competent to partake of those deliberations, and aid in that research which is to provide a code for the conduct of the entire profession. In the duty of revision recently performed by the College, at the request of the Medical Convention, great and valued services were rendered by her graduates, who, at the period, corresponding to the present, as regards the future revision, occupied a ground no more in advance than you do now. Yet were they chosen to aid in the work, and so may some of you be, if you listen to the counsels here addressed to you, and respect the advice which you receive at our hands. A no more honorable motive to exertion, or more commendable ambition can well be excited, than that which is thus held out of the opportunity for a seat in that council which is to legislate for the whole nation. You may all aim at this distinction, and herein you have a stimulus to which, with the exception of the class assembled during the last term, none of your predecessors were subjected.

The advantages and valued benefits which the College is enabled to provide those who regard her precepts, and make her instructions the rule of action for their professional lives, great as they have always been, are now much enhanced by the prospect for distinction already alluded to, and by the anticipation of preferment to her own vacant chairs. A hope legitimately indulged by her

pupils. It may be the lot of some one of you to fill this very place from which you are now addressed; and should the selection ever be made from among you, the choice will undoubtedly fall upon him who may prove himself most deserving. His deserts being measured by the coincidence which may appear between his own character and the professional and moral attributes already stated. To no class of young men do greater or brighter prospects open than to yourselves. Your anticipations of a successful professional life are heightened by the preferments already pointed out. Nor are they limited to them; the wide field of employment, as professional teachers, is opened in all its extent to you, as well as to others, whenever you prove your abilities to discharge such duties. We have all seen, in the past history of our own College, that desert has met its reward ; and in the promotion which some of her professors* have realized, that through her porches and forum lies one road to eminence and distinction. This way lies open to you as well as others, provided the prerequisites of character, knowledge, and faithful devotion to duty be adopted as your motto, and ever cherished as the objects of your search and incentives to your exertion.

These encouraging prospects which have been shown to gild the terminus of the journey upon which you are now advancing, may with confidence be regarded as the rewards of time well employed now; but recollect, that their acquisition depends upon evidence of merit; and with the same certainty that merit will be appreciated, may you anticipate ignoble disregard and insignificance, if that evidence be wanting. It is greatly to be feared that numbers have left these scenes of instruction, and it may be the purpose of some of you to do the same, unfurnished with one important link in the chain of proof. Of the number who are inscribed as pupils since the institution of these lectures, now nearly twenty years, who have availed themselves of the advantages thus provided, how few have presented themselves for examination, and secured for themselves an honorable distinction as

* Professors Jackson, Wood, Griffith, and Bache.

graduates of the College? Surely, of the large number who have drank from these fountains of instruction, there must be many capable of proving that their thirst has been slacked, and their labor refreshed by the draught, than our records are able to show. No enduring evidence remains with us, of their attainments, they "come like shadows, so depart," satisfied with their own sense of their acquisitions, their own estimate of their capacity to fulfil all the requisitions of their profession. Can it be that the honorable ambition of winning the honors of the College, and the approbation of their preceptors, has been overcome in some, by diffidence, in others by dread, or by some, let us hope but few, who, from a homefelt consciousness of utter incompetency, have shrunk from an examination, certain of disgrace? What injustice do those who withhold themselves from examination do to their own characters, and how depreciate their attainments in the eyes of all their friends, by thus voluntarily leaving College, unprovided with its Diploma, unfurnished with any evidence that their studies have been pursued with advantage? If all who have left these halls, in this destitute condition, had reflected upon the parallel which they had drawn of themselves with the most ignorant and unqualified, they certainly would have felt one sentiment of self-respect, one spark of ambition, one throe would have been excited to shake off their ignoble associates, one effort would have been made to dissolve the degraded connexion. It is a self-debasement which they thus impose, in suffering their dread of a vague, uncertain difficulty, to prevent their entering as candidates for the reward which the College presents to those who prove themselves worthy to receive it. In the public eye, all who leave here without such examination, are classed together as unable, from incompetency, to obtain a diploma, as all those who do submit to examination and secure evidence of their qualifications, are regarded with favor, and esteemed as proficients, by the judgment of the same tribunal. The distinction being more marked and obvious, from the strong contrast in which the two classes are placed by comparison. Let those who have slighted the proffered reward of the College, known to

have been in attendance, at the same time with others who have sought and obtained it, take care lest the contrast be attributed to inability, and reflect that those in whom this deficiency is found, may have attached to their names the stigma of rejected. This may appear a harsh judgment, and undoubtedly it is so; but recollect that those by whom it is made are unacquainted with the cause; they judge from apparent results, and however eroneous their decision, it is based upon the voluntary assumption of the condition which is thus liable to misconstruction. Most assuredly from such, the selection of those who are to be installed in Professorships, will never be made, nor are they those in whom public confidence will be placed, or on whom favor and emoluments be bestowed. The time is, I trust, not far distant, when public opinion, at least, if public law or the requirements of the College do not, require that every candidate for confidence as a Pharmaceutist, shall be compelled to prove his attainments and exhibit his diploma, as evidence that his professions may be relied upon. Trusting to the influence of generous emulation, and the regard of youth for the approbation of its seniors, the College has not as yet thought proper to enforce, by special enactment, the possession of a degree, by all who desire to become incorporated with her in membership, nor has she insisted that all who attend her lectures shall be compelled to apply for her diploma. She has trusted to the value of her approbation thus formally expressed, to invite application for it; and relying upon this incitement, has ever held the character of her certificate above suspicion. In no instance that has come to my knowledge, has it been undeservingly awarded ; nor has ever the ambition of presenting a long list of graduates, tempted her to award it to an unworthy applicant. Competition, the motive which might induce in other cases a relaxation of requirement, exists not with her; and jealous of the character of her recommendation, she holds it only within the reach of the deserving. If such be the value of her diploma, and such be the disadvantages of wanting it ; if its attainment be placed within reach of all but those who are

negligent and ignorant; if the College affectionately invite all who come to her for instruction, to apply for it, and withholds all means of compelling the application, why is it that so many have denied themselves the possession ? Disposing, in a word, of those who feel satisfied of their inability and total absence of claim, of those who, conscious of neglected opportunity, and misspent time, who, sensible that their application for a diploma would justly be in vain, let us for a moment examine a case which has elsewhere been supposed, as actuating the conduct of another class—diffidence, or apprehension that the requirements are too severe, and that the diploma is beyond their reach. There is, perhaps, no more commendable trait in the character of the young, than a modest regard of their attainments, and none which more surely attracts the favor and wins the regard of their seniors. As the poet expresses it:

"Humility is the softening shadow before the stature of excellence
And lieth lowly on the ground, beloved and lovely as the violet.
Humility is the fair-haired maid, that calleth worth her brother;
The gentle, silent nurse, that fostereth infant virtues;
Her countenance is needful unto all, who would prosper in either world;
And the mild light of her sweet face is mirrored in the eyes of her companions,
And straightway stand they accepted, children of penitence and love;
As when the blind man is nigh unto a rose, its sweetnees heraldeth its beauty,
So when thou savorest humility, be sure thou art nigh unto merit."

Excellent, then, as such a sense of diffidence is, it is doing injustice to those in whom the duty of examining the candidate is reposed, to dread the examination, from a fear that more will be required than opportunity and means have been afforded to acquire. Such dread is entirely unjust, and is based upon imaginary difficulties, which the experience of every graduate who has passed the ordeal, has proved to have no existence. These difficulties are altogether fabled; chimeras of fancy, having no reason for their foundation; and indulged almost invariably by none but those who have

an exquisite sensibility for commendation, who look for praise for a mere act of duty, and dread lest the discharge of that duty might be esteemed as sufficiently paid by its accomplishment. And who are they upon whom this insinuation of injustice is cast ! Are they strangers, having no sympathies for the feelings and interests of the candidate ? Are they cotemporaries, jealous of his success, or anxious to defeat him ? Are they those who, ignorant themselves of their profession, are incapable of appreciating the knowledge of it in others ? Far be it from any one of those who has suffered his dread to keep him away from the tribunal, to answer these interrogatories in the affirmative. The facts are too glaringly opposed to such assertions, not to appal the stoutest hardihood which would hazard them. Instead of strangers, destitute of sympathy, they have had those who had known and anxiously watched their progress in knowledge ; instead of jealous cotemporaries, they have had generous seniors, most desirous of the success of the candidate ; instead of ignorant judges, incapable of discovering merit, they have had the knowledge and experience of their professors, aided by members of the College, specially selected for their fitness. Away then, with the dread of difficulty, and relying upon industrious application to study and observation, let no such excuse ever be offered for the neglect in future.

> " Our doubts are traitors
> And make us lose the good we oft might win,
> By fearing to attempt."

Let the remarks here suggested, while they pay all possible deference to real diffidence, serve to banish this dread of too severe an examination, and expose the fact that such excuses are mostly had recourse to by him, who would brave the charge of ignorance, risk the stigma of incompetent, hazard the title of rejected !!!

Let me beseech you, who now are about to constitute the class, who will be placed in the position of those of whom we

have spoken; who must have the choice of accepting or refusing the offers of the College to guarantee your attainments; let me beg you to determine this day not to reject the offer. Let this day witness the establishment of a new era in the history of the College, which is to be characterised by the resolution of each one of you to become a candidate for the degree, when you shall have fulfilled the conditions which entitle you to apply for it. If such a resolution be adopted by each of you for himself, with a steady purpose to adhere to it, the stimulus thus given to exertion will put into your power the means which will enable you to reach the destined goal. How great is the value which should be placed upon the diploma by those who do obtain it, has been somewhat exhibited by the strong terms in which a want of it has been represented. It cannot, therefore, be needed, that an extended argument should be spread before you to display all the advantages, and set forth all the benefits which may be expected to be derived from its possession. The necessity for a diploma in the hands of him who would seek further preferment, who would soar to the highest regions of professional rank, has been shown to be indispensable; and that the gratification of an honorable ambition in securing this means of elevation is not of doubtful morality, is evidenced by the establishment of it by universal consent, and by those who have been appointed to conduct your education and promote your welfare. But, independently of this view in which we have regarded it, and which may be thought as far beyond the reach to which any of you aspire, consider the value of a diploma to one who seeks, in the quiet of private life, the discharge of the ordinary duties of his profession. Regarded merely as a testimony of the approbation of your instructors, and the evidence to yourselves that your studies have been pursued with advantage, resulting in solid attainment, an evidence, by no means so easily and certainly obtained as by an examination by others, its possession is eminently deserving of your efforts. This, perhaps, is one great incitement with some, and justly so. To him who is diffident of his abilities, and doubtful of his preparation for

rendering justice to those who may confide in his skill, assuredly it must be a great satisfaction and ground of confidence, that by the assurance of persons qualified to determine, he has, upon an exhibition of his claims, been found so prepared and duly entitled to support. The only evidence, short of a diploma, which can establish the same facts, are long practice, and the invariable employment by those who are willing to hazard your skill thus unsupported by evidence. The disadvantages of submitting to such an ordeal present great obstacles to your early success, if, indeed, any can be found willing to trust you at all, while they may so readily procure the services of others known to be competent. Relying upon this means of establishing your character, you may toil for years, waiting the result which a graduate already possesses in the exhibition of his diploma. Here is positive, certain, respectable testimony of persons, known to the public to be capable of judging, who, by affixing their signatures to your diploma, stake their reputation for your competency, and guarantee your claims to the support and patronage of the public. The contrast thus afforded of these two opposite conditions, self-selected by the respective parties, should alone determine your choice, and induce you to adopt the resolution already submitted to you, not to entrust your qualifications for the world to adjudge them, while you may have the verdict of a competent tribunal, enabling you to reap a harvest at once, which otherwise years may be required to produce. It cannot be supposed that immediate confidence will be placed in the ungraduated, or that opportunity will be immediately afforded them to satisfy the public, while there are those presenting themselves who have already, by their graduation, evinced their claims to regard, and established their professional character. But enough said. You feel the appeal which has been made to you, and acknowledge that the sanction of the College to your deserts is not a worthless achievement.

A few words are here addressed to those, if any such be present, who, desiring merely a general insight into chemistry, have no particular employment of the knowledge in view,

other than the great delights which flow from the possession of truth, and especially those truths, which reveal so much of the power, wisdom, and glory of the Creator,—he who possesses not the knowledge of the infinite relations of elementary matter, which chemistry alone teaches, can never understand and enjoy the pleasure derived from an acquaintance with the order, harmony, and invariable laws with which matter of all kinds has been endowed by the Almighty. To such it may be necessary to explain, that the professional character of the course opposes no obstacle to the study of general chemistry to an extent quite commensurate with the wants of a general student. Every principle required for a finished education is required for the peculiar wants of a professional student, and therefore no sacrifice of the requisites of a general is made to the demands of a special course of study. It will be an effort constantly exerted to render the lectures delivered from this desk, entertaining and instructive to all who may feel disposed to attend, whether student or amateur; an attempt which it would not be worth while to enlarge upon here. Let an attendance upon the course decide the claim which it may possess to those epithets.

And now, young gentlemen, who are about to embark with me on an untried voyage, let me invite from you a steady determination to give your best efforts to the purpose for which we are associated; let me ask on your part a decorous, faithful, punctual attendance, and a confidence in the sincerity in which the preceding remarks have been addressed to you; and I pledge you, on my part, a constant regard to the objects which have brought us together; and an anxious hope that our destined haven may be reached, the good ship laden with a precious freight, and a decided determination to spare no means which a conscientious discharge of duty may intimate as necessary to your improvement and permanent good. One means is afforded us which we must all respect, 'the advice and example of those more experienced than ourselves; a regard for the attainments of those who have gone before us. Brilliant as are the prospects held out to you; gratifying as

are the sentiments with which you look forward to the completion of your studies; pleasant as are the paths by which your progress is to be made, be not disappointed that you find some checks to your advance, obstacles to be surmounted, difficulties to be overcome. Industry, perseverance, and contentment, will be your aids in adverse circumstances, and, triumphing over every impediment, bring you to the attainment of your goal. But, I refrain from further comment upon your prospects, or further incitement to duty; at your age, with your means of success, and your sense of the necessity of exertion, such remarks are unneeded. Let me close my address with the statement, that it has come from one who has experienced all that he describes as pertaining to your situation, and having since realized some of the benefits which are promised to follow exertion, he invokes your confidence in the advice which he offers, your reliance on his assurance that EFFORT WILL MEET SUCCESS.

ART. II.—OBSERVATIONS ON ZAMIA INTEGRIFOLIA—THE PLANT WHICH AFFORDS FLORIDA ARROW ROOT. By Joseph Carson, M. D.

Read at the Pharmaceutical Meeting of the College of Pharmacy, Feb. 14, 1842.

The source of "Florida Arrow Root" appears not to be commonly known to Pharmaceutists, the generality of whom have attributed it to the same plant that affords the Bermuda article, the *Maranta arundinacea.* The supposition that both these varieties of the drug were obtained from the plant mentioned can readily be explained. It is well understood that the *Maranta arundinacea* is found in other localities besides the island of Bermuda, in which it either grows spontaneously or is cultivated; thus it is common in Cuba, Jamaica, and other West India Islands; the close proximity of these localities to the coast of Florida, therefore, naturally induced the belief that it also existed in this *juxta tropical* portion of our country, independently of the vague reference by authors to such a location. The existence of it in Florida, whether correctly asserted or otherwise, has nothing to do with the origin and derivation of the article designated as Florida Arrow Root, as it is now ascertained to be obtained from an entirely distinct vegetable, possessing wholly different characteristics.

Florida Arrow Root has been brought so frequently into our market, as to have become known to most of our druggists, and yet in no authority do we find an allusion to a difference of source, nor has any suggestion been thrown out with respect to its true origin. In drawing up the present communication, which has been attempted with the desire of filling a chasm existing in our Pharmacological knowledge, it should be stated that I am indebted for many of the facts contained in it to officers of our army, who, at different times,

have served in Florida, (particularly Dr. Abadie,) who have not only communicated to me information, but have also supplied me with specimens. To these gentlemen was the feculent substance not only familiar, as it afforded them an article of food, but also the plant from which it was procured.

The plant from which Florida Arrow Root is derived is the *Zamia integrifolia* of botanists; a plant which for a long time has been known and described. Under the name of *Zamia pumila*, we find it noticed in the "Species Plantarum," of Linnæus; in the "Species Plantarum," by Willdenow, however, it is described by the title of *Z. integrifolia*, with the citation of *Z. pumila* as a synonym. Willdenow refers to the HORTUS KEWENSIS of *Aiton*, who appears to have drawn up his account of it from living specimens, as it was introduced by John Ellis, Esq., in 1768, and cultivated in the hot houses of England. In *Curtis' Botanical Magazine* for 1816, there is given a description and figure of the plant; the female alone is there represented. In the same work is also presented the figure of another species, the *Z. media*, which would apppear to be hardly worthy of any other distinction than as a variety. The representation of the plant, however, had previously appeared in the "*Icones*" of Jaquin.

From ENDLICHER'S "*Genera plantarum*," which is now regarded of the highest authority, we have obtained the following *generic description*.

"706. ZAMIA, Lin. *Flores masculi:* Antheræ apertæ, in strobilos terminales, pedunculatos collectæ, undique rachi communi insertæ, singulæ ovoideæ, basi in stipitem attenuatæ, apice incrassato peltiformi, sub-bilobæ, lobis-subtus polliniferis. *Flores feminei*; *Carpidia* plurima, monophylla, aperta, in strobilos terminales pedunculatos collecta, rachi communi undique inserta, singula basi in stipitem attenuata, apice in peltam hexagonam dilatata, pelta subtus utrinque *ovulo* unico, inverso, fœta. *Fructus* e carpidiis subdiscretis. *Semina* ovoideo-subglobosa, testa ossea, epidermide tenuiter carnosa cincta. *Embryo* inversus, in axi albuminis carnosi, radicula respectu racheos communis centripeta."

706. Zamia L. *Male flowers:* Anthers open, collected in pedunculated terminal strobiles, inserted all round a common rachis. Each one ovoid, attenuated at base into a stipe (stalk) with an apex uniformly peltiform, subbilobate, lobes polleniferous beneath. *Female flowers:* carpels numerous, one-leafed, open, collected in pedunculated terminal strobiles, inserted all round a common rachis, each at base attenuated to the form of a stalk, dilated at the free extremity, which is hexagonal and peltiform, face beneath bearing a single inverted ovule. *Fruit* sub-discrete. *Seeds* ovoid sub-globose, testa bony, enveloped in a thin fleshy epidermis. *Embryo* inverted, in the axis of the fleshy albumen, radicle centripetal with respect to the common rachis.

1. *Specific description. Zamia integrifolia.*—Frondibus pinnatis, foliolis lanceolatis, rotundato obtusis, basi attenuatis, exteriore ad apicem serrulatis, stipite glabro subtetragono. WILLD.

Specific description. Zamia integrifolia.—Fronds pinnate, folioles lanceolate, rotundo obtuse, attenuated at base, serrulate at the apex, stipe smooth, subtetragonal. WILLD. *Sp. Plant.*

The *dwarf zamia* has a root in the form of a somewhat spherical coated tube, rough and dark colored externally; the crown of the root, which is usually above ground, is sometimes as thick as a man's arm, dividing below into several stout branches and fibres. The *leaves* arise immediately from the root in a cluster, and are from a foot to two feet or more in length; pinnate in form. The *leaflets* are from ten to twenty pair, opposite or alternate, sessile, each two and a half or three inches long, and varying in breadth from a quarter to three-fourths of an inch, entire, rather shining, strongly striated on both sides with parallel ribs, the extremity rounded obtuse, slightly serrated at the apex; the common stalk smooth, somewhat quadrangular. The *cones* arise from among the leaves, on stalks several inches in length, the *male* are three inches long, an inch wide, of a reddish-brown color, the *female* thicker and larger. The *fruit* is three or more inches

long, elliptical, pointed, downy, the scales finally separate widely, each is peltate and angular, remaining after the drupe has fallen. The *drupe* is elliptical, about half an inch in length, with a small quantity of sweet orange-colored pulp, and a large rather-pointed nut.

The Z. *media* differs from the present species in having more numerous, longer, and narrower leaflets, which are perfectly entire, or nearly destitute of the servatures at the extremity; the foot-stalk is not as smooth, and the female cone is obtuse and not pointed. It has been called media because it appears to be intermediate between Z. *angustifolia* and Z. *integrifolia*.

The natural family to which Zamia belongs is *Cycadaceæ*.* The dwarf Zamia, by all the authorities we have consulted, is referred to East Florida, and by a few to the West Indies. Willdenow refers it to St. Domingo. Pursh informs us that it is "only found in Florida," and that he had made every inquiry to find it in Georgia, but without success. Mr. Bartram, in his travels, states that "it grows in the open pine forests, in tufts or clumps." It appears also that the *Zamia media* is found in similar localities, from the references attached to the specimens in the Herbarium of the Academy of Natural Sciences.

The root of this plant contains large quantities of feculent substance, a fact which is overlooked by all the authorities above quoted; Mr. Nuttall, however, remarks that the farina is wholesome and nutricious, and that the root is one of those called by the aborigines *Tuckahoe* or *bread*. The specimens in our possession present masses of almost pure feculæ, dense, weighty, and of a pure white color, tasteless and

* The different species of Zamia were originally supposed to be ferns, from the resemblance of the leaves to this tribe; a mistake which is sometimes made by common observers at the present time. To a certain extent there is an affinity to *Palms*, but the resemblance is not carried out beyond the pinnate leaves and large cylindrical stems. Palms are monocotyledonous, while the Cycadaceæ are dicotyledonous, and there are other points which evince dissimilarity.

inodorous. By the Seminole Indians the tubers are extensively consumed as an article of food, prepared by roasting, a purpose to which they are also put by the white inhabitants and the army of Florida. They afford a substitute for potatoes. From the dense hard substance, when dried, the Indians are also in the habit of constructing the bowls of their pipes, which are lined with tin or a metallic substance. There are two varieties of the root—the white, and another having a reddish hue internally; the latter is mostly used for the construction of pipes.

Coonti is the name by which this root is known in Florida and the Southern States; a name which is also applied to the prepared farina, and under this title it is taken into the markets of the South; with the view to such disposition, it is prepared by the descendants of the Spanish settlers in the neighborhood of St. Augustine. The mode of preparation is the same as that of common arrow root.

Compared with the Bermuda arrow root, the Florida article has more of a mealy appearance and feel, and is of a duller white color, with less of the crystalline lustrous hue. When carefully prepared, it is, however, pure white, but is apt to be lumpy like that obtained from the tapioca root. When examined with the microscope the form is that of "a half, a fourth, or third of a solid sphere," conforming to the account which has been given by Raspail of the form of the granule of the *Maranta aurundinacea.* (*See this Journal*, vol. v. *New Series*, pp. 23.) Now, as we have determined by observation that the form of the granules of Bermuda arrow root is round, the conclusion is inevitable that Raspail mistook the source of the article that he examined, and that it must have been the identical article under consideration. I am indebted to Dr. Goddard for first directing my attention to this fact.

ART. III.—REMARKS ON SYRUP OF WILD CHERRY BARK, AND ON SYRUP OF VALERIAN. By W. PROCTER, JR. and J. C. TURNPENNY.

Read at the Pharmaceutical Meeting of the College, Feb. 14th, 1842.

THE bark of the *Prunus Virginiana*, as an article of our Materia Medica, is daily becoming more in use, and its admitted value as a remedial agent, renders any suggestions having a pharmaceutical bearing upon it, of some importance. The existence of amygdalin in this bark, and also of a substance which reacts with it like emulsin in the bitter almond, so as to generate a volatile oil and hydrocyanic acid, has been elsewhere shown ;* hence, in all the aqueous preparations of the bark, hydrocyanic and volatile oil are present, and the wisdom of employing cold water as a menstruum, as directed by the U. S. Pharmacopœia, is apparent.

The long time required to make the infusion by maceration in the ordinary way, gives additional advantage to a preparation which, while it possesses all the virtues of the other, as being made without heat, contains them in a more concentrated form, and is capable of preservation for a long time.

With these preliminary remarks, we will state that the following formula yields a preparation of good quality, containing all the activity that the quantity of menstruum appears capable of extracting.

Take of	Wild Chery bark, in powder,	℥iv.
	Water,	℥xii.
	Sugar, in coarse powder,	℥xxiv.

Macerate the bark in the water for forty eight hours ; put the mixture into a displacement apparatus ; return the fluid that passes several times, until it becomes transparent, and then add sufficient water to displace twelve fluid ounces of in-

* American Journal of Pharmacy, Vol. x. page 197.

fusion. Place the sugar in a displacement funnel, and pass and repass the infusion through it, until it is all dissolved. Lastly, preserve in well stopped bottles.

Syrup of Valerian, 1st.

Take of Valerian, in powder, ℥j
Water, ℥iij.
Sugar, in coarse powder, ℥vj.

Macerate the Valerian in the water for forty-eight hours, and displace so as to obtain three fluid ounces of infusion; then, having placed the sugar in a displacement funnel, treat it with the infusion until it is all dissolved.

2d.

Take of Valerian, in powder, ℥j.
Water, ℥ijss.
Alcohol, ℥j.
Sugar, ℥vj.

Proceed precisely as in the preceding formula.

There are some occasions where the effects of Valerian is wanted, unassociated with that produced by the presence of alcohol. The first formula embraces this idea, and fully answers its object. The second, where alcohol is no objection, forms a more ready means of exhausting the valerian.

We have tried the formula of Soubeiran, for Syrup of Valerian, but think the above afford superior products, which, at the same time, are more readily and easily obtained. His method consists in macerating the Valerian in the water for ten hours, and drawing off one-third by distillation. The residue in the retort is strained and filtered, the proper quantity of sugar added to it, and dissolved by means of heat, and finally, after it has cooled, the distilled water is mixed with it.

ART. IV.—OBSERVATIONS ON HYDRATED PEROXIDE OF IRON, DEMONSTRATIVE OF ITS DECREASE IN POWER, AS AN ANTIDOTE FOR ARSENIOUS ACID, BY AGE, AND SOME HINTS ON THE METHOD OF PREPARING IT. By WILLAM PROCTER, JR.

Read at the Pharmaceutical Meeting of the College, Feb. 28th, 1842.

FEW subjects have attracted more attention in the *medico-chemical* world, than that of the antidotal power of the hydrated peroxide of iron, in its relations with arsenious acid; and indeed so many papers have been already written upon it, that nothing but the importance of some of the views now offered, would have induced the writer to have added to the number.

Many months ago, in preparing some tartrate of iron and potassa, not having quite enough of the recently precipitated oxide of iron, a portion of the hydrated oxide, which had been prepared nearly a year before as an antidote, and kept under water, was resorted to, but it was observed that the latter was dissolved very slowly by the tartaric acid, and the great difference in that respect from the recent, was a matter of surprise, and suggested the idea that a like difficulty would occur in a still greater degree, when arsenious acid was employed.

Under the impression that, if several specimens of the hydrated peroxide of different ages, which had been kept under water, were subjected to trial, as to their activity in removing arsenic from solution, conclusions might be drawn which would settle the question definitely, a series of experiments were undertaken, and the result of these corroborate the suggestion, that this substance gradually decreases in activity by age, notwithstanding it may be kept under a stratum of water. If this position is fairly established, as it is believed to

be by the following observations, then it becomes a matter of some moment, both to the physician and the apothecary, to be acquainted with the fact and to adopt a remedy.

Nine specimens of the hydrated peroxide of iron, all of which had been kept in the moist way under water, and most of them in bottles hermetically sealed, were treated in the following manner, viz. : The percentage of dry oxide which they severally contained having been ascertained, so much of each as was equal to thirty-six grains of the oxide, was placed in a vial, and three grains of arsenious acid, in solution, added, the mixture occasionally shaken, and tested to ascertain if the arsenic had been removed from the solution.

A. A specimen made about four years ago, and appeared to be in a finely divided state. The mixture of this specimen and arsenious acid was tested occasionally with ammoniacal sulphate of copper, and ammoniacal nitrate of silver, for three days, at the expiration of which time, a portion of the filtered liquid was treated by Marsh's apparatus, which gave evidence of the presence of arsenic, although, previous to the addition of the solution, no spot could be obtained.

B. A specimen two years old, in appearance similar to the preceding. This was treated as above, and at the end of three days the solution contained arsenic.

C. A specimen two years old, apparently more dense than the preceding, was found equally, if not more inactive.

D. A specimen which had a thicker consistence than any of the preceding, preserved its gelatinous character to a greater extent, and was about two years old. All the arsenic had been removed from the solution in twenty-four hours.

E. A specimen nine months old, very thick in its consistence, having much less water mixed with it. This was diluted to the proportion of the other specimens, the arsenic added, and the latter was entirely removed from solution in four or five hours.

F. A specimen made at the same time as D, but having less water mixed with it, being so thick that the vessel could

be inverted without its changing its position. This, when diluted, removed the arsenic in three hours.

G. A specimen twelve months old, and after twenty-four hours contact with it, the solution yet contained arsenious acid.

H. A specimen, precipitated three months ago, was found to remove the arsenic in ten or fifteen minutes.

I and *J.* Specimens precipitated for the occasion, removed the arsenic in five to eight minutes.

In looking over the above results, and comparing them, the difference in the activity of the specimens is quite apparent, and those which are the least active are on the side of age. But independent of any influence that mere age may have in its deterioration, other circumstances most probably influence the powers of the preparation. It was invariably found, that those specimens which were most diluted, that is to say, which had the largest proportion of water admixed, all other circumstances being equal, were least active; whereas, those which preserved the state of *magma*, having little water mixed with them, were most active. Thus specimen F, made at the same time as D, was much more active. By having much fluid associated with them, the particles of the hydrated oxide, after being kept some time, appear to contract in some way, so as to take up less space in the bottle. It is not probable that this preparation undergoes any change through the agency of the atmospheric oxygen, the iron being already at its maximum of oxidation; hence, the most accurate exclusion of the air, will not prevent its deterioration, and this must be attributed to another cause. Orfila has stated, in a note to the Academy,* that colcothar, which is an anhydrous peroxide of iron, possesses no antidotal power, that is to say, it does not combine with arsenious acid. He says that if two millegrammes (.3 of a troy grain) of arsenious acid be boiled

* American Journal of Pharmacy, Vol. xiii. page 331, from Journal de Chim. Med.

for two hours with water in which sixteen grammes (247 grains) of colcothar is suspended, the filtered liquid will still afford arsenic by means of Marsh's apparatus, and hence that 833 times the weight of the acid will not neutralize it.

Is it not probable that the true reason of the deterioration of the preparation will be found in a combination of the oxide and water when recent, which does not exist in that which has been long kept? That the presence of water is a condition of its activity, has been shown by the experiment of Orfila, quoted above. To ascertain, if possible, whether the hydrate long kept (under water) had the same amount of water in its composition as that recently precipitated, four specimens were taken from those previously used, viz.: A, C, E, and I. The two first, four and two years old, the two last nine months old and recent. They were dried at a temperature of from 80° to 90° Fahr., for twelve hours, a given quantity of each was introduced into glass bulbs afterwards balanced, and then subjected to a red heat, until they ceased to lose weight. The loss was in the following proportion.

A,	8.4
C,	7.2
E,	12.
I,	13.

These experiments were repeated with nearly similar results. This statement shows that the recently precipitated oxide contains nearly double the amount of water that is contained in the two first, and more than is in the third. Whether the *proportion* of water combined with the oxide is a condition of its activity or not, the above statement, taking either view of the subject, is a curious coincidence; the proportion of water being very nearly that of their activity, as seen by reference to the previous experiment.

Orfila further says in the paper before alluded to, "I have proven by numerous experiments, that if the hydrated perox-

ide, instead of being in the state of *magma*, be used dry, that is to say hydrated but not moist, and at a temperature of 36° to 40° centigrade, 16 grammes will neutralize about six decigrammes (9.26 grs. troy) of arsenious acid. At least the aqueous liquid, resting over 16 grammes of the hydrated oxide, which had previously contained 6 decigrammes of arsenious acid for some hours, did not become yellow on the addition of a solution of hydro-sulphuric acid, to which a few drops of hydro-chloric acid had been added."

From these remarks it is evident that the dry oxide is not so active as that recently precipitated, as less than half the quantity of the latter removed the same proportion of arsenious acid from solution in about five minutes; indeed, it must be evident, that in a case where such feeble affinity is exerted, so great a change in the state of aggregation of a substance like hydrated oxide of iron as is produced by drying it, and afterwards triturating it to powder, would materially interfere with combination. To test the matter, however, the following experiments were made, viz.

Sixty grains of recently precipitated oxide, dried at a temperature of from 80 to 90° Fahr., was mixed with water and 3 grains of arsenious acid in solution added, and the mixture occasionally shaken. In half an hour the arsenic was removed.

Sixty grains of a dry hydrate, six weeks old, had not removed, in seven hours, three grains of arsenic; but 120 grains of the same oxide separated the same quantity in about four hours. Sixty grains of a specimen of hydrated oxide made a year or more, had not removed the same quantity of arsenic when examined in twenty-four hours;—120 grains of the same oxide removed the arsenic in about ten hours.

From these observations it is clear that *quantity* may, to a certain extent, make up for *quality*. They also render it probable that if a larger proportion of the specimens *A. B.* and *C.* in the first series of experiments had been employed, that they would have removed the arsenic sooner, but this does

not do away with the evidence of those experiments, viz. that hydrated peroxide of iron deteriorates by age, etc.*

Orfila again observes, "MM. Nonat, Deville and Sandras, have advised, and with reason, to use in preference the dry hydrated peroxide, because it contains in the same weight four times the amount that it does in the state of magma; and they also advise to give 16 grammes of the hydrated peroxide for each grain of arsenious acid to be neutralized."

It cannot be doubted that the dry hydrated oxide can be administered in less space; but at the same time it is equally true that the recently precipitated oxide is much more active, and should always be employed in preference, and besides the recent article from its levity would remain perfectly suspended in the fluids of the stomach and be active at every point.

The case spoken of by Dr. Fisher in his elaborate paper on this subject (in the 12th vol. of the American Journal of Pharmacy) where an oxide eight months old was successfully employed, agrees with the conclusions arrived at in the above experiments, as it has been seen that an oxide two years old, in one instance, removed the arsenic in three hours. But at the same time that we agree with Dr. F. that every apothecary should keep the oxide ready prepared, we believe that in all cases, when the recent is attainable, it should be resorted to in preference as being more active.

Method of preparing the hydrated peroxide.—Dr. Fisher recommends that this preparation be made directly from the metal, by first forming a sulphate of the protoxide and then per-oxidizing by nitric acid, precipitating by ammonia and washing. This course will always give a pure prepara-

* Since the above was written, six grains of arsenious acid in solution was introduced into a half pint bottle of the antidote, containing about six drachms of the hydrated peroxide which had been prepared two years. Three weeks afterwards the filtered solution was strongly charged with the arsenic, notwithstanding the mixture had been frequently agitated.

tion, (if the iron is good,) but the length of time it takes is an objection to its adoption, at least in a case of urgency. There are few pharmaceutists but have in their possession a sulphate of iron pure enough for making this preparation. By employing the sulphate ready made, the time of making is reduced one-third.

Take of

Crystallized Sulphate of Iron, in coarse powder,		℥xx.
Sulphuric Acid,		℥iij.
Nitric Acid,	(sp. gr. 1.4)	℥iiiss.
Water,		Oiss.

Add the sulphate of iron to the water, previously boiling in a suitable vessel, and when it is dissolved add the sulphuric acid. To the boiling solution the nitric acid is to be added in small quantities at a time, continuing the ebullition after each addition until the whole of the acid has been added and the solution has attained a deep reddish-brown color. The dark liquid thus obtained is a concentrated solution of the tersesquisulphate of iron, and forms a ready means of obtaining the hydrated per oxide.

Another method which has been proposed is to take any quantity of nitric acid, specific gravity 1.3, and add powdered sulphate of iron in small quantities at a time until effervescence ceases, then applying heat to drive off the absorbed deutoxide of nitrogen. The only objection to this process is that the resulting solution is a mixture of two equivaleuts of tersulphate, and one of ternitrate of the peroxide of iron, and when an alkali is employed to precipitate the oxide, an alkaline nitrate remains in solution which, if not wholly removed, would be more likely to irritate the stomach than the sulphate of the same base.

However prepared, the strength of the solution should be known. Every hundred grains of the crystallized sulphate of iron employed, yields nearly thirty-eight grains of the hydrated peroxide; and by knowing the quantity of sulphate employed and of solution obtained, the percentage of oxide in

the solution is easily found. As made by the first formula, provided the resulting solution measures two pints, each fluid ounce contains one hundred and fourteen grains of hydrated peroxide.

This solution should be kept in every shop as a source for obtaining the peroxide for antidotal purposes, or for any of the preparations of that oxide called for in the course of business.

Having this solution at hand, supposing a sudden demand for the antidote occurs, the pharmaceutist should form a judgment as to the quantity of oxide wanted, and take a corresponding amount of the ferruginous solution, mix it with its weight of water, and add a very slight excess of solution of ammonia to precipitate the oxide.

The whole should be thrown on a coarse flannel, and by gradual pressure as much as possible of the fluid be removed. By again adding water, and compressing, the oxide is obtained sufficiently washed for the first exhibition, so that no time be lost, and the remainder should be treated more completely, yet as rapidly as possible, so as to continue its administration at short intervals. By this course, the first doses may be administered in 10 or 15 minutes, if the manipulator has exercised ordinary skill.

It is, of course, to be understood that the peroxide should be kept constantly on hand by every apothecary. After having washed it he should introduce it into bottles, in the form of a thick magma, so that after standing even for several months there should be little separation of water. This, however long kept, or even the dry hydrated peroxide (the precipitated carbonate of the U. S. P.) should be at once administered while the recent is making, and thus save time, but the importance of having the recently prepared oxide, particularly where the amount of poison taken is large, cannot be doubted.

In the case of the Gigon family, in which nine persons were poisoned by arsenic, reported by Drs. Smiley and Wallace in the Medical Examiner, the writer had an opportunity of put-

ting the above mentioned process in practice, and furnished the oxide to the patients in twenty minutes after being advertised of the demand.

In conclusion we may observe,

1st. That hydrated peroxide of iron, even when kept under water, gradually decreases in its power of neutralizing arsenious acid.

2d. That if kept in the form of a thick magma, it will retain its properties longer than when mixed with much water.

3d. That this decrease in power is probably due to a change in the relative proportion of the oxide, and the water chemically combined with it, as well as to an alteration in its state of aggregation.

4th. That from the experiments of Orfila, and others, the dry hydrated oxide possesses the power to a considerable extent of neutralizing arsenious acid, and it should be used in the absence of the moist and recent preparation.

5th. That hydrated peroxide of iron may be obtained in a state fit for use in 10 or 15 minutes, by using a solution of the persulphate of iron. And,

Lastly. That the recent oxide should be used in all cases where it is attainable, in preference to that long kept.

REPORT.

The Committee to whom was referred the "Observations on Hydrated Peroxide of Iron," &c. by Wm. Procter, Jr., respectfully

REPORT, That they have little to add to the full remarks upon this subject contained in the paper referred to them. With regard to the change in the state of aggregation, induced by keeping the hydrated peroxide suspended in water, their own observations have confirmed those of Mr. Procter, and they consider his experiments as conclusively showing that we cannot rely upon the hydrated oxide after it has been prepared a certain length of time.

It is a question of some interest, whether the antidote, if carefully dried without, or with a very gentle heat, would not preserve its efficacy longer than when kept suspended in water. Orfila found, as quoted in the paper, that 16 grammes of *dry* hydrated peroxide neutralized 6 decigrammes of arsenious acid, but does not mention how long this oxide had been prepared. In a paper by Dr. Beck* on this subject, he says, that Dr. Van Specz, of Vienna, exhibited rust of iron successfully: and further, that the Academy of Medicine in Paris found the "common subcarbonate of iron" (probably the prepared carbonate of the Pharmacopœia) an efficient antidote. Notwithstanding this, Dr. Beck, in a subsequent part of the same article, says, that "the dry hydrated oxide is inert." There is no doubt that this is the case as respects *colcothar*, which, however, contains no hydrate.

Your Committee endorse the recommendation of Mr. Procter, that the apothecary keep always on hand a solution of the persulphate of iron, from which the hydrated peroxide may be quickly prepared in case of emergency;—and in the mean time the "precipitated carbonate" of the Pharmacopœia might be had recourse to with advantage, as it usually contains more or less of the hydrated sesquioxide.

We believe that it is not advisable to neutralize the ammonia which remains with the precipitate after moderate washing, as advised by Mr. Procter, as we conceive the therapeutic effect of this alkali desirable, as stimulating the tissues of the stomach, and assisting it to reject its noxious contents, and also in counteracting the prostration, which is well known to be one of the earliest effects of the poison. Orfila has found that the insoluble compound of arsenic and peroxide is still poisonous, proving fatal when administered to animals, though far less virulent than the arsenious acid. This poisonous effect he attributes to the action of the acid of the gastric juice upon the compound, decomposing it and liberating arsenious acid, and it may be prevented by giving

* See Journal of College of Pharmacy, vol. 13, No. 3.

a large excess of the hydrated peroxide, by which means the arsenious acid, as fast as it is liberated, unites with and is neutralized by a fresh portion of the hydrated oxide. The ammonia, by neutralizing the acid in the stomach, would of course tend to prevent its action upon this compound.

In conclusion your Committee would remark, that however strong may be our dependance upon the antidotal effect of the hydrated peroxide, no available means should be neglected to procure the rejection from the stomach, by vomiting, of as large a portion of the poison as possible, both before and after the administration of the antidote.

AMBROSE SMITH,
ROBERT BRIDGES, } Committee.

Philadelphia, March, 1841.

ART. V.—OBSERVATIONS ON THE ACTION OF ETHER ON GALLS. By Robert Bridges, M. D.

Read at the Pharmaceutical Meeting of the College, Feb. 28th, 1842.

The process usually directed for the purpose of procuring tannin from galls is that of Pelouze, viz. by the action of ether. This method affords the most ready and easy mode of accomplishing the ultimate result, but with regard to the primary effects of the action there exists some discrepancy in the statements of chemists. According to the original observations of Pelouze, if galls be acted upon by displacement with ether which has been previously washed with water, there will result a liquid, which by repose will separate into distinct layers, the upper of which consists principally of ether, water, gallic acid, and a little tannin, while the lower consists entirely of pure tannin dissolved in water. Immediately on the publication of this statement, the experiments were repeated by Liebig, who, acknowledging the great superiority of this over all previous methods, differs however in his statements as to the results; remarking, that the etherial liquor deposits only a very small quantity of the syrupy solution of tannin, but that this effect is produced by the addition of a small quantity of water. The liquid then forms two distinct strata, the lower of which is a solution of very pure tannin. In explaining this he states that tannin, when anhydrous, is soluble in ether, but becomes insoluble by combining with water. M. Beral states that acting on an aqueous solution of galls by ether, we obtain three layers, the lower of which is the solution of tannin. "The separation of tannin," he remarks, "is solely due to the property possessed by this substance of combining with determinate quantities of water and ether," forming a syrupy liquid which he denominates "liquid tannin."

These discrepancies result from the different circumstances

under which the experiments have been performed, as will be evident from the following observations. Ether as in the shops, may be under four different forms, viz: Ether combined with alcohol; ether combined with water; ether combined with both alcohol and water; and, finally, though very rarely, uncombined with either.

By the action of the ordinary ether of the shops* (sp. gr. .750) upon powdered galls in a displacement filter, there results a greenish-yellow liquid, which does not separate, on standing, into two portions. On agitating this solution with ten per cent. of water, it immediately becomes milky; and on repose, separates into two very distinct layers, the upper of which is etherial in its character, and of a light green color, while the lower is dense and syrupy, of a light yellowish-brown color. The addition of a larger amount of water causes the liquid to separate, on repose, into three distinct portions. The upper layer resembles the upper layer before spoken of, but considerably diminished in bulk, while the liquid below consists of two portions of nearly equal density. One portion is of a light yellow color, and aqueous appearance, the other yellowish-brown and syrupy. The specific gravity of these two portions so nearly coincide that the position of each will depend upon very slight causes. At first, the syrupy solution is above, from entangling within itself some portions of air or of the etherial liquid, but, in course of time, subsides, and falls through the other portion like a thick oil. A larger portion of water causes an increase of the aqueous portion, and a diminution of the others.

Each of the liquids by evaporation yields products of different degrees of purity, but all containing tannin. The product, from evaporating the etherial solution first mentioned, contains of course all the impurities dissolved out of the galls by

* When eight measures of this ether were shaken with four measures of water, the loss was two measures. The resulting ether again shaken with water, in the same proportion, lost half a measure. This last represents the washed ether subsequently mentioned.

the ether and alcohol. This is a greenish-yellow sparkling powder. The product resulting from the evaporation of the upper layer, formed by the action of a small quantity of water, is of deeper green than the former, consisting of much tannin, green coloring matter, and other impurities: the lower liquid yields a powder of a yellowish color, which is tannin contaminated with a small quantity of brown coloring matter. In the case of three layers the results are similar as regards the etherial and syrupy portions, while the aqueous yields a product apparently intermediate between the others, but small in proportion to the amount of liquid.

This etherial solution, by filtration through animal charcoal, is, in color, greener than before, but of less intensity. The products resulting from the evaporation of the various liquids are also less colored, with the exception of the etherial portion which still retains its green color unaltered. When ether, previously washed with water to separate alcohol, is substituted for ordinary ether, the resulting liquid is greener, but with less depth of colour, and occasionally deposits a small amount of a very light, yellow, oily solution of tannin, and on evaporation yields a smaller product. When the oily matter does not appear, it may be produced by agitation with water, much less, however, of this liquid being required in this than on the former occasion; a larger addition also resulting in three layers as before, the only difference consisting in the lower portions being a yellow of much less depth. These different liquids on evaporation yield products similar to those before mentioned, with the exception that the results from the lower portions contain less coloring matter.

If this etherial solution from hydrated ether be well mixed with alcohol, in proportion of four measures to one, and then agitated thoroughly with one measure of water, the mixture will lose its transparency, but without becoming milky, and on repose will gradually separate into two portions, the lower of which is limpid and colorless, but not syrupy in consistence, while the color of the upper etherial solution has increased in depth. These two solutions on evaporation yield

respectively pure, colorless tannin from the former, and a green residue from the latter consisting of tannin, coloring matter, and other impurities. By this means about one half the tannin in the solution may be separated of the utmost purity. The result is not the same with the solution from ordinary ether, the lower always retaining some portion of the brown coloring matter.

Acting on galls by means of ordinary ether, to which water has been united by means of alcohol, there results a liquid of which the brown hue increases in depth with the increase in the proportion of the alcohol and water. This liquid does not separate on standing, but when the alcohol and water bear but a small proportion to the whole, the addition of water has the same result as with solution from ordinary ether; if, however, the latter liquid predominates, then this result is effectual by the addition of ether. The alcohol does not act here as when hydrous ether is used, for both portions into which the liquid separates, contain much coloring matter, the green with part of the brown remaining in the upper portion, the under exhibiting a light yellow color, and on evaporation yielding a yellowish product.

The theories of Pelouze and Beral, which do not essentially differ, afford, with slight modifications, the explanation of the above results. The modifications necessary are to bring into view the relations in regard to the solubility of tannin, whether anhydrous or combined with ether and water, and of coloring matter with ether, alcohol, and water. Anhydrous tannin is freely soluble in water, less so in alcohol and in ether. When in contact with water and ether, combination takes place, which results in the formation of an oleaginous liquid, considered by M. Beral to consist of definite proportions of each of its constituents. This compound is soluble in alcohol, ether, and water, but to much less extent than anhydrous tannin. The coloring matter existing in galls is of two kinds, a brown or deep yellow matter, insoluble in ether and soluble in alcohol and in water, but having a stronger affinity for the alcohol, and

a light green coloring matter soluble in ether, and probably also in the other liquids, but with a more especial affinity for the former.

These data will suffice to understand the different results stated in the former part of the paper. Ordinary ether, acting on powdered galls, dissolves tannin, the ether present taking up at the same time the green coloring matter, and the alcohol the brown; the quantity the latter dissolved being proportional to the relative amount of its appropriate solvent. No water being present, the liquid tannin of M. Beral is not formed, and hence there is no separation of an oily liquid. The addition of water affording the necessary prerequisite for the formation of this compound, it is consequently produced on the addition of a small quantity of that liquid, and being less soluble gives rise, on repose, to a separation into two parts. The color of these two portions is different, the upper consisting principally of ether, holding in solution some liquid tannin, retains the green coloring matter, while the brown coloring matter, being insoluble in this fluid, goes with its solvent water to be present in the oleaginous liquids. The addition of an excess gives rise to the formation of an additional layer, consisting of a solution of liquid tannin in water, together with some ether and green and yellow coloring matter, this latter layer being produced at the expense of both the other layers, and is hence intermediate in qualities between them.

Employing ether, deprived of alcohol by previous washing, and in which water has replaced this liquid, a liquor is produced in which there is present both "liquid tannin" and anhydrous tannin. If the water present be sufficient to form more of this liquid tannin than can be dissolved by the ether, then there results a deposit of the excess as a dense oily liquid; but when not sufficient in quantity the addition of more water immediately produces the result, and we then have the liquid tannin separating on repose. The water in the washed ether being small in amount, dissolves but a small quantity of brown coloring matter, from whence it results that the oily liquid pos-

sesses less color than when common ether is used. We may here take advantage of the greater affinity of the brown coloring matter for alcohol to procure a purer product. On adding this liquid to the etherial solution, it takes the brown matter from the water and still retains it on the addition of more of this liquid, the lower layer separating free from all color. The etherial compound appears also under the circumstances to be decomposed, for the solution does not, as in the other instances, become milky, and the colorless fluid separated by repose, is not oleaginous. Should this additional alcohol be mixed with the ether previous to its action on the galls, then more of the yellow coloring matter would be dissolved by the alcohol than could subsequently be retained, and some would pass to the aqueous solution and render the product impure.

ART. VI.—REMARKS ON SOME OF THE MERCURIAL COMPOUNDS. By James Hamilton, M. D., Baltimore.

There are few medicinal agents embraced in the Dispensatory, more frequently employed in disease than the compounds of mercury, and of them it is to be regretted many are employed without a due knowledge of their composition, or the principles on which they act.

In this remark, the preparations of *Pil Hydrargyri*, *Hydrargyrum cum cretâ* and *Unguenta Hydrargyri*, are particularly alluded to, and as such are intended to be the subject of this article.

The cause of the efficacy of these preparations has led to the adoption of many opinions, reducible however to two, viz. the presence and agency of the protoxide of mercury, or metallic mercury, in a minute state of subdivision; each of these has been upheld and supported by numerous contributors to periodicals, some teeming with contradictions and assertions which can only be attributed to ignorance of the principles of chemistry or a desire to win popular esteem as authors; it is not to be wondered at, then, that even at the present day this question is acknowledged to be unsettled, inasmuch as but little positive proof has been brought forward by many of those who have thus far enlightened the medical world with their opinions.

As the question is one of undoubted interest to the intelligent physician, and is based on some of the properties of *mercury* itself, these necessarily will require an examination first, in order to relieve us of the discrepancies which appear in many of the articles already published on the subject.

The metals may be divided into two classes as regards the changes to which they are liable under common circumstances, some being oxidized at the common temperature; others remaining unaltered, and mercury in this respect is not sufficiently known to be classed in either; Turner, Green,

Brande, Gay Lussac, and a number of others asserting that it is unaltered, when pure, by exposure to air. Lagrange, Murray, Nicholson, Priestly, Fourcroy and others, on the contrary, that it slowly assumes the state of a protoxide.

Wood and Bache, in the U. S. Dispensatory, assert that "when perfectly pure, it undergoes no alteration by the action of air or water, but in its ordinary state suffers a slight tarnish," and follow it up by saying that "mercury, as it occurs in commerce, is *very pure*." From repeated observations, however, it is satisfactory to me, that pure as the metal may be, when exposed to air repeatedly, a gray film forms on its surface, which is increased by agitation and other circumstances to be alluded to hereafter; the mercury used in these observations has not only been carefully distilled, but also tested by appropriate chemical agents to prove its entire separation from any other metals with which it is sometimes adulterated, and which impart to it a facility of oxidation.

By continued agitation it has been long known that this change is easily accomplished, as even in the time of Bœrhaave, (who first obtained it by subjecting mercury to the motion of windmills, carriage wheels, &c.) this fact was well known, and the oxide designated *Ethiops per se*, and many of the authors who have denied its capability of oxidation by exposure to air, grant, that combined with agitation, this change is easily accomplished; there seems to be no doubt in this respect, that mercury when exposed to the action of air, becomes slowly oxidized and more rapidly when agitated; "by long agitation with access of air it becomes converted into a black powder or oxide, which gives out oxygen by heat, the metal being at the same time revived."*

The presence of extraneous matter is, however, acknowledged by *all* to facilitate this change. "It is oxidated even at natural temperatures when subjected to agitation, or *still more easily*, when triturated with any viscid matter, which is interposed between its globules so as to extend their surface;"† but it does not require the aid of trituration to effect

* Ure. † Murray Mat. Med., 1827.

this, as I have been assured by those who are compelled to resort to pure mercury, that simple contact with oils or other viscid matter has this effect to such an extent as to render it useless to them until purified by distillation, and all who have been in the habit of using pure mercury in their manipulations, must have observed the rapid oxidation whenever brought into contact with foreign substances.

PIL HYDRARGYRI.

This mercurial compound is as frequently employed as perhaps any other, though the results often obtained from its use are not equal to what are anticipated. In the United States and London Dispensatories, the mercury is triturated with confection of roses and liquorice root; in the Edinburg with conserve of roses and starch ; in either case the materials are triturated until all appearance of metallic globules has ceased, and the mixture has attained that blueish-gray appearance which has given rise to the name of blue mass.

A diversity of opinions are entertained with regard to the cause of the action which results from its use, some attributing it to the presence of the protoxide of mercury, others to mercury in a very minute state of subdivision. Let us examine the grounds which the latter have for this supposition.

Mr. Carpenter, in a memoir on "the Extinction of Mercury by Trituration," (Philadelphia, 1827,) has been at considerable pains to attempt to prove that the mercury is only in a minute state of subdivision and not oxidized, in which it need only be said he has failed.

Laugier (Cours de Chimie, tom. 11, page 310,) says, "on est fondé a croire aujourdhui que ce changement de couleur tient seulement à l'extrême division desparties du metal," &c.

The United States Dispensatory, (1839,) says: "it was formerly thought that the metal was oxidized in the process, and that the medical activitv of the preparation depended on the

presence of the black or protoxide of mercury; at present, however, the change is generally attributed solely to the *mechanical division of the metal, which in this state is supposed to be capable of acting on the system,*" &c.

In a paper communicated to the Journal of Pharmacy, (Philadephia, 1829) by Mr. Allison, it is attempted to be proved:

1st. That the presence of the adhesive substances used in the preparation of the mass, "effectually prevent the contact of the air with nearly all of the metal employed."

2d. That the time used in its preparation is too brief for any action to take place even if the first objection were removed, (no doubt alluding to the fourteen years which Dr. Duncan relates that Bœrhaave exposed his mercury to the action of a windmill,) and finally comes to the conclusion, that the popular idea of the inertness of metallic mercury on the system is erroneous.

In opposition to this we have testimony of much more weight, and founded on the authority of the best chemical authors. Ure, Eberle, Paris, Coxe, Murray, and a number of others, confirm the opinion generally received, that mercury in its uncombined state has no action on the system, and the authors of the United States Dispensatory declare, "*that it is considered to be inert.*" No metal can have any action on the system, or form any salts until oxidation first occurs, and those writers whom we have quoted assert that it is difficult to oxidate mercury at common temperature; again, metallic oxides are only active, inasmuch as meeting with the free hydrochloric, acetic or other acids in the stomach they then form soluble and active salts. In order then to prove that mercury has any action on the system in its metallic state, it must first be proved, that *acids act on pure metals,* which is utterly impossible; next, that mercury is an exception to all the rest of the class of metals in its action on the human system.

On what principles of chemical reasoning can it be asserted

that the mercury acts by virtue of some exclusive power, or that it can form a soluble salt in the stomach in its metallic state, but when we consider the oxide of mercury as the active agent, then we may readily account for its activity, as we can understand that a chloride or acetate of mercury has been formed from the acids to which we alluded, and a corresponding effect produced.

But it is said by some, (United States Dispensatory, for example,) that the action is attributable "solely to the mechanical division of the metal which in this state is supposed to be capable of acting on the system." If, then, these effects are produced by it in a minute state of division, why is it that in cases where from its weight it has been administered in large doses these effects are not increased? Were it a solid substance, such a supposition might have some weight, as, of course, the more minutely divided the more easily would action be induced; but mercury being a fluid, and its particles easily separated, this supposition is rendered out of the question, and hence it is found necessary to have resort to another mode of explaining it, by supposing, as Mr. Phillips has done, that the mercury exists in the form of a *suboxide;* but let the existence of a suboxide of mercury be first proved before its *supposed action* be used in theories.

As to the idea of the action of metallic mercury on the system, it is contradicted by the knowledge of the properties of all the rest of the metals, as however active or even poisonous their compounds may be, they themselves are entirely inert, as instances of which gold, silver, antimony, arsenic and others may be adduced. As to the idea of mercury in a minute state of subdivision, possessing this action of which so much has been written, it is not entitled to the slightest credence. In cases of persons where large quantities are given to act by its weight, there would be intense action and profuse ptyalism produced if possessed of any property of this kind, whereas, we find the only inconvenience to which the patient is subjected is the weight consequent on its use. It is also known that in the extraction of this metal from its mines,

it becomes insensibly so incorporated, (if the term may be allowed) in the system, that a miner on passing a piece of gold or silver coin between his hands, covers it at once with an amalgam, and still suffers no inconvenience from being subjected to its influence. In the latter case the mercury must be in a most minute state of subdivision, to such an extent as not to be visible on the surface, and consequently in a state best calculated to act on the system.

The proof that Mr. Allinson has attempted to bring forward is easily refuted from the evidence which has already been adduced: 1st, those agents which he seems to think prevent oxidation by protection from contact with air, have been shown by the best authority to be the very cause of the rapidity of oxidation which ensues, and the 2d objection, viz. the time not being sufficient for the oxidation of the metal, is removed by the same means.

In his experiments on blue mass to detect protoxide of mercury, he states, "*I boiled* it in successive portions of distilled water until all the soluble matter was dissolved, then digested the residue in acetic acid with heat; no acetate of mercury was found;" but this is not astonishing, as Turner, whom he has quoted in his article, states, that the protoxide "is *easily affected by heat* by the direct solar rays, and even by daylight;" and if so liable to decomposition, the repeated application of 212 F. was quite sufficient to resolve it into peroxide and metallic mercury, neither of which are acted on by acetic acid.

But we have authority of much more weight, proving the presence of the protoxide of mercury as the active agent in this preparation. Eberle,* in the description of its preparation, says, "the globules disappear, and the metal assumes the state of a black oxide," and Paris† confirms it in the following language: "The mercury in this preparation is not, as it was formerly considered, in a state of mere mechanical division, but in that of a black oxide, upon which its activity as

*Therapeutics, 1827. † Pharmacologia, vol. 2, 263.

a remedy undoubtedly depends; for mercury in its metallic state is entirely inert with regard to the living system."

In a series of experiments in relation to this subject, Mr. Donovan* has satisfactorily proved that one hundred grains, or parts of mercury, after being rubbed or triturated for forty hours with honey, *yielded ten per cent.* of protoxide of mercury, and "its introduction as a substitute for those preparations in which the metal is oxidated by friction, is supposed to be advantageous from the uniformity of strength, as the others are liable to vary from imperfect preparation; when properly prepared, it appears to be the same in chemical composition, and the medicinal operation of it also extremely similar."†

These experiments of Mr. Donovan have long since decidedly settled this question in Europe, with the exception of some of the French writers, who are generally loth to adopt ideas promulgated by their English cotemporaries, but the opinion of Dr. Thompson‡ on the subject is at least entitled to respect, as proof of the importance which deservedly is attached to them. To counteract the effect of at least some of the essays which have been written on this subject, I have recently examined samples of the several varieties of blue mass which are found in our drug stores, and with the following results. Repeated washings by water, *at common temperature,* was used at first to remove the feculous and saccharine matter, after which the residue was digested with pure acetic acid diluted, which, being slowly evaporated, yielded flaky crystals of acetate of mercury.

Hydrochloric acid was then substituted for the acetic, evaporated, and the white residuum was rendered black by the addition of potassa, ammonia and hydrosulphuric acid, prov-

* Annals of Philosophy, vol. 14. † Murray.

‡ "Every chemical reader who peruses the paper will agree with me in thinking, that it possesses unquestionable merit, and that Mr. Donovan has added very materially to the accuracy of our knowledge of the compounds of mercury," &c. *Thompson's Annals*, vol. 16, page 17.

ing it to be protochloride of mercury; these experiments were conducted in a manner not intended to ascertain the quantity or per centage of oxide of mercury, but to prove its presence, which, to my own mind, they most satisfactorily have done. Finally, as to the cause of the activity of this preparation, no one who has any knowledge of even the elementary principles of chemistry, can ascribe it to any other than the presence of the protoxide of mercury; and to uphold any other belief, to say the least of it, betrays ignorance of the properties of the metal and its compounds.

Among the varieties of this article met with in this country, all or nearly all are prepared in England, and should be carefully examined before being used. Some manufacturers, in order to brighten the color of the conserve of roses, used in its preparation, add to it a small quantity of sulphuric acid, which remaining in contact with the mercury, (or its oxide rather) forms a sulphate of mercury formerly called Turpeth Mineral, violently irritative in its action, which of course it imparts to the mass with which it is incorporated; of this several examples have been recently observed, and the pernicious effects clearly traced to this cause.

One of the best preparations which has been seen for some time past occurs in pound rolls, wrapped in tin foil and brown paper, with a plain label of "Pil. Hydrargyri" on the outside, and presumed to be manufactured by Davy Macmurdo & Co., London.

HYDRARGYRUM CUM CRETA,

Though generally considered as less important and less frequently used than Pil. Hydrargyri, still forms a component of the physician's prescription. It is prepared by rubbing together three parts of mercury, and five of prepared carbonate of lime, until all appearances of globules have ceased to be visible, even with the aid of a lens.

Its action has been attempted to be explained, on the supposition that it is only mercury finely divided, but when de-

composed by hydrochloric acid in excess, the residue will be found to darken on the addition of ammonia, &c. indicating the union of the acid with the protoxide of mercury. By this it is not intended to deny that the greater part of the mercury is in a minute state of division, but to assert that in this condition *it is inert,* and only owes its activity to the portion which is oxidized. As this compound is generally obtained, it is from manufacturers in London, where it is made on a large scale, and hence always contains more protoxide of mercury than when prepared according to the directions of the United States Pharmacopœia. This must be evident, inasmuch as in the preparation of eight ounces (the quantity recommended by the United States,) the mercury is not subjected necessarily to the same action and exposure as when prepared by machinery on a larger scale, and is proved by the result that the English article, when given to children, will generally act as an emetic, and occasionally violently so, whereas when prepared in smaller quantities, it exerts an opposite effect, and even will allay vomiting. Numerous cases have confirmed the truth of these remarks, and a compound like this which is generally used in the diseases of children, where the stomach is generally irritable, should always be prepared by the vender; when properly prepared there is no mercurial compound of a milder character, less liable to objection, better suited to the diseases of children, and proves at the same time the fallacy of the idea which attributes its action to aught else than the protoxide of mercury.

UNGUENTA HYDRARGYRI.

In these preparations the mercury is gradually extinguished by trituration with lard, suet, and other oleaginous compounds, and the different varieties only depend on the relative quantity of each ingredient. To enter into any minute investigation as to the cause of their activity is deemed unnecessary, as, if the principles which have been already mentioned be correct, (and they are justified both by chemical

reasoning and experimental proof,) the activity of all the varieties of the blue ointments, as they are generally termed, must be owing to the presence and chemical combination of the protoxide of mercury with the fatty matter. If not, why are these changes in color observed in the ointment, which every one who has prepared and used it, must have noticed? Why is it, that an ointment of twenty-one grains of protoxide of mercury to one ounce of lard has been found by Mr. Donovan to possess the same power of producing ptyalism when used in smaller quantities? (and recommendations from the different hospitals in England have testified to its effects.) Why is it, that in the various manipulations of gases with a mercurial trough, in which the hands are frequently dipped in contact with the mercury, that ptyalism is not produced? But those who uphold this theory must explain its action on the system when taken up by the capillaries in the *metallic* state; granting absorption into the capillary and lymphatic system in the *metallic* state, can it be proved that any metal exerts any influence on the system internally or externally applied, unless that influence is occasioned by its combination with some other agent, as oxygen, iodine, &c.

When mercury has been proved in its metallic state to act on the system, as an exception to all other metals, or when acids can be found to act upon metals without oxidation, *then* it will be granted that the action of the preceding compounds are not dependent on the presence of the protoxide of mercury.

Maryland Medical and Surgical Journal.

ART. VII.—ON THE PREPARATION OF IODIDE OF IRON.

By Dr. A. T. Thomson.

Having had the satisfaction of introducing the Iodide of Iron, as a therapeutical agent, to British Practitioners, I feel anxious that its preparation, should be such as will prevent the rapid decomposition of the salt, and the formation of the Sesquioxide of Iron, whenever it is exposed to the air, whether in the sold state or in solution, a circumatance which has been regarded as an objection to its employment.

Daily experience has demonstrated that the solid salt cannot be preserved long, even in well stopped bottles ; and when the evaporation has been conducted by the aid of lime, and carried to the greatest point of dryness, as proposed by Messrs. T. and H. Smith, Chemists in Edinburgh, whose process has been adopted in the Edinburgh Pharmacopœia, the salt is still susceptible of rapid decomposition. It is a mistake, however, to suppose, as Messrs. Smith have done, that the result of this decomposition is a peroxide and a Periodide of Iron. On the contrary, it is a mixture of Iodide of Iron, Sesquioxide of Iron, and *free* Iodine. This is rendered obvious by throwing the decomposed mass into water—the sesquioxide falls to the bottom, whilst the solution, which contains the iodide, has the deep brown color of the aqueous solution of Iodine, and a powerful odor of that substance ; it instantly, also, forms the Iodide of Amidine when it is added to a cold solution of starch. Unfortunately, it has, too often, been dispensed in this state ; and, consequently, it has been productive of much injury in cases in which the Iodide of Iron was clearly indicated, but in which the free iodine, in the decomposed preparation, was likely to prove hurtful.

With these facts in view, it is remarkable that the only preparation of the Iodide of Iron, ordered by the London College of Physicians, is the solid salt ; and that this form of the preparation is also ordered in the new Edinburgh Phar-

macopœia. But a solution of the Iodide, which is intended to contain about four grains and three-fourths of a grain of the Iodide in each fluid drachm of the solution, is, also, ordered by the Edinburgh College. A piece of iron wire is properly directed to be kept in the bottles containing the solution, a mode of preserving the solution of a definite strength, which was suggested by my friend, Mr. Squire.* Although, in a solution thus treated the Sesquioxide of Iron is formed and precipitated, yet as soon as the oxidizement takes place, the free Iodine instantly combines with an equivalent of the Iron, which supplies the place of that which is oxidized, and the solution remains of the same strength, in reference to the Iodide, as when it was made, even when the bottle containing it is a fourth or more full of the Sesquioxide of Iron. This fact is readily demonstrated by filtering the solution and evaporating a given quantity of it, to ascertain its solid contents. The addition of the coil of soft Iron to the solution, therefore, obviates, in a great degree, the objection to the em-

* The following is an extract from an article of Mr. Squire, on the subject, published in the " Annals of Philosophy," in May, 1836 (page 79.)

"The Protiodide of Iron was first employed in medicine in this country by Dr. A. T. Thomson, and has since kept its character as a valuable tonic. The great inconvenience arising from its tendency to decompose when dissolved in water, is completely obviated by a coil of iron wire traversing the whole column of the solution, which was suggested by me, when it came into extensive use as a therapeutic agent, and nearly three years experience proves it to answer most satisfactorily the object intended; it will preserve it perfectly neutral, even if the solution be fully exposed to air and light. It is true, in that case more peroxide is formed; but filter the solution when you will, it is perfectly colorless and transparent as distilled water. This is a very important point, and one which the medical profession should be made fully acquainted with, being a safe test for its neutrality and purity. Any color, however slight the tinge, shows the presence of some iodine in a free state, or some impurities derived probably from one of the materials employed to make it; this, no doubt, has given rise to the difference of opinion as to its action on the animal economy. The colorless neutral compound, when diluted, has an agreeable flavor, similar to that of a chalybeate spring, whereas any free iodine gives a mawkish taste, and is liable to nauseate the stomach."

ployment of the preparation which arises from the difficulty of preserving it ; and, as the solution can be made of any definite strength, it forms an excellent mode of prescribing it, for the deliquescent nature of the salt renders it necessary to prescribe it always in solution. I have long been in the habit of prescribing it in a solution of three grains to a fluid drachm, a strength which enables it to be ordered in small doses with more facility than the Edinburgh solution, as every minim contains one-twentieth of a grain of the Iodide.

It might reasonably be argued, that the solution properly prepared, and preserved with a coil of wire in it, is adequate for every practical purpose; but, when it is ordered to be given in drops, the deposition of the sesquioxide of Iron in the bottle has often created a disgust to the medicine in the minds of some patients, and has led to an idea that the preparation was spoiled, and had consequently lost its efficacy, or that it had been improperly prepared. Besides, the keeping it in this manner renders it necessary to *filter* the solution before it is sent from the shop of the chemist ; and also to introduce into the phial a coil of Iron, which often leads to ludicrous observations on the part of patients. A lady, to whom I had ordered a bottle of the solution to be sent, and who lived in the country, wrote to me, desiring to know "whether the Iron screw, which the bottle contained, was to be swallowed entire after the solution was finished, or whether it was to be taken, in divided portions, with each dose of the solution?" This query, although a playful manner of inquiring into the use of the coil of Iron, yet displays the impression which it is likely to make on the minds of patients.

For these, and other reasons, as well as to obtain a definite preparation of the Iodide of Iron, not susceptible of decomposition, I made a variety of experiments with different combinations, and at length succeeded, by forming it into a *strong Syrup*, which will not only remain undecomposed, when exposed to the air, for an indefinite length of time, but which may be crystallized, and given in the form of powder with various substances, which would otherwise decompose the so-

lution. The following is the method which I have adopted for preparing the Syrup.*

"Take two hundred and fifty-two grains of Iodine; forty-eight grains, or any quantity, of *pure soft* Iron wire, perfectly *free from rust*, and twelve ounces and a half of *distilled* water. Boil them together in a narrow-necked flask, until the fluid becomes nearly colorless; filter the solution into a deep capsule, kept hot; evaporate to two-thirds, and add as much refined sugar as will make a *thick* Syrup, aiding its solution with a gentle heat. The Syrup should be so thick as to admit of the addition of as much boiling distilled water as will make the whole twelve ounces and a half, so that each fluid-drachm of the Syrup will contain three grains of the Iodide of Iron. It is unnecessary to preserve the Syrup in stoppered bottles, or to seclude it from the light."

Whether the boiling may render it necessary to add water

* A Syrup of Iodide of Iron was suggested in Bachner's "Repertoire de Pharmacie," in the year 1839, and is mentioned in the "Journal de Pharmacie," Jan. 1840. But the mode of preparing it is objectionable, a fact which is rendered obvious by the following sentence appended to the notice: "Hengel has observed, that this Syrup is at first brown, but it soon assumes a paler color, without depositing any Oxide of Iron." There is also an article on the subject in the "Journal de Pharmacie," March, 1841.

The reader is also referred to an article "On the Preservation of the Protiodide of Iron, by William Procter, Jun." in the American Journal of Pharmacy. *Vol.* 10, *Page* 13. *April*, 1840.

In the Journ. de Pharmacie, for Sept. 1840, we find a proposition by M. Oberdoirffer, a Pharmacopœlist, at Hamburgh, to substitute a Sesqui-iodide of Iron for the Iodide. He proposes to prepare it in the following manner:—"Take sixteen parts of Iodine, six parts of iron filings, and thirty-two parts of water; and form the Iodide of Iron. Filter the solution, and having diluted it with 128 parts of water, add six parts of Iodine, and as much pure water as will make the whole up to 320 parts." M. Oberdoirffer remarks, that it produces the same effect as the Iodide of Iron, but it is more active.

It is scarcely necessary to say, that this is not a Sesqui-Iodide, but a mixture of the Iodide and free Iodine. It is the presence of the latter that the Syrup is intended to prevent.—T.

to the Syrup, or whether after the Syrup is made, the augmentation of bulk may render evaporation necessary, the Syrup, when completed, should measure exactly twelve fluid ounces and a half.

This Syrup, well prepared, undergoes no decomposition when it is exposed to the air or the light. It admits of combination with astringent vegetable infusions, decoctions, and tinctures, and also with the diluted mineral acids, all of which decompose the aqueous solution of the Iodide. To make the crystallized Iodide, the Syrup should be exposed to a warm dry air in a shallow vessel until crystals form.

The same method may be employed for making the syrup of *Iodide of Zinc*, which may be crystallized also, in the same manner as that of Iron.

I propose to name the crystallized Syrup, Crystalli Ferri Iodidi Saccharati.

The specimen of the Syrup, which accompanied this Essay, was prepared in December, 1840, and has remained perfectly limpid.

Lond. Pharmaceutical Transactions, August, 1841.

ART. VIII.—ON THE PREPARATION OF UNGUENTUM HYDRARGYRI NITRATIS. By Mr. Alsop.

The remarkable difference in the appearance and quality of the Unguentum Hydrargyri Nitratis as usually met with, has long engaged my attention, and being a matter of considerable practical importance, I am induced to submit a few observations to the consideration of the Society. The want of success so frequently experienced, has been rendered the more puzzling by the uniformity of result in the hands of some persons, by whom no small degree of mystery has been long affected: and while we cannot doubt that the experimenters of the college obtained a good article by the formula of the Pharmacopœia, it is a reasonable subject of inquiry, Why so many, although professedly using the same formula, are not equally successful? and, Why such discrepancy of opinion in this particular should be found amongst medical authors?

The Edinburgh Dispensatory of 1794 gives the following formula, viz.—"Quicksilver, 1oz., nitrous acid, 2 ozs., hog's lard, 1 lb. Dissolve the quicksilver in the nitrous acid by digestion in a sand heat, and while the solution is very hot, mix it with the lard previously melted by itself and just beginning to grow stiff, stir them briskly together in a marble mortar, so as to form the whole into an ointment."

In this process the directions appear to have been framed with a view especially to restrain the violent action of the nitrate on the fat, and speedily to cool the ointment.

In the valuable Dispensatory of Dr. A. T. Thompson, 1824, after giving the present formula, he recommends the use of only one-sixth of lard, by which an excellent ointment appears to have been produced; he adds, the observation that "when made with a larger proportion of lard, it becomes hard and brittle, of a pale, dirty, yellow hue, marbled with green blotches."

On the other hand we find, in the Dispensatory of the

United States, this view of the subject pronounced to be a "mistake;" that it is "the olive oil which is hardened by the supernitrate of mercury, and that the ointment is firmer when made with that oil alone, than with a portion of lard." Hence in the last edition of their Pharmacopœia, they have directed neat's-foot oil to be substituted for that of olive, with, it is stated, decided advantage, thus,—"Take of purified mercury, 1 oz., nitric acid, 11 fluid drachms, fresh neat's-foot oil, 9 ozs., lard, 3 ozs.; dissolve the mercury in the acid, then melt the oil and lard together, and when they begin to stiffen (upon cooling) add the solution and mix them." It is admitted, however, that change had taken place in some which had been prepared upwards of four months, which, although soft, had partially assumed a greenish color. The acid is stated to have been of specific gravity 1.325.

Amid these contradictory statements, I made a few experiments a few years since, which I think afford a practical solution of the difficulty: Under the idea that the hardening of the ointment was due to the olive oil, I prepared some by the substitution of oil of almonds, and obtained an ointment of beautiful color and consistence, and which was not altered by keeping. The next trial was not equally successful; from which it was evident that the result depended more on the manipulation, and perhaps on the acid, than on the particular kind of fat employed. Since that time I have never had my ointment become hard, or materially changed by keeping. On a comparison of various experiments, I am satisfied that the point most important to be attended to, is the due regulation of the heat, so as to effect the needful decomposition of the nitrate. If the mixture be made at a low temperature, no effervescence takes place, and the ointment so produced will become hard in a few days, of a greenish white color, and eventually of a consistence that may almost be powdered; but if the oil or fat is heated to a sufficient temperature, or the quantity operated upon is large enough to generate the heat required, strong effervescence takes place, much gas is evolved, and a perfect article is produced, of a fine golden color and the consistence of butter.

In the laboratory of John Bell & Co.,* and also in the army laboratory (in both which establishments a most perfect article is produced) I find that but little heat is employed beyond what is required to melt the lard, but on the other hand the quantities are large, so that a considerable temperature results from the decomposition, and the stirring is kept up at intervals for several hours, by which the evolution of gas is assisted. I have not as yet minutely examined the gas evolved, or the state of the lard and mercury, on which field of labor much time might be employed; but I find that the extrication takes place at a temperature of about 180°, and that at 212° it is so violent that the mixture frequently boils over unless the vessel is capacious.

In my first successful experiment with oil of almonds, such a temperature was employed, by which the required change was effected. If this effervescence is pushed too far, although the consistence of the ointment is not injured, the color is deteriorated either immediately, or after a few days, by the partial reduction of the mercury; the same result is also sure to happen if the proportion of acid is not sufficient, and this will of course be the case wherever the proportions of the Pharmacopœia are observed, *without regard to the specific gravity of the acid employed.* This is the second point on which I place peculiar stress. I find the nitric acid supplied to us by the most respectable manufacturers ranges usually from 1.375 to 1.4, equivalent only to from 66 to 73 per cent. of standard acid of 1.5, it is therefore necessary to increase the quantity in proportion to its deficiency in strength. I apprehend that this dilution is adopted on account of the spontaneous decomposition of the strong acid, observing at the same time that the nitric acid of the Pharmacopœia is not colorless

* The following is the formula of J. Bell & Co.

℞ Hydrarg. ℥viij.
Acid. Nit. f℥xiv. (Sp. g. 1.43.)

Solve et adde.

Adipis, lb. iij.
Ol. Olivæ, lb. ij.

acid, but a pale nitrous, which latter acid is supplied in commerce of a much greater density, and approaching 1.5.

At first sight I was struck by the large proportion of acid in the formula of Dr. Duncan, viz. three times the quantity of the mercury, and in that of the army laboratory which is as follows,—mercury, 1.lb. 5½ ozs., nitric acid 3.lb. 9 ozs., lard 8.lb. 4 ozs., olive oil, 5 pints, wine measure, but on reducing the proportions to accord with the relative strength of the acid, as regards that of the army laboratory, I find no material variation from the Pharmacopœia order.

The difficulty in the preparation of a good article, from the reasons stated, is less obvious to those who prepare it in large quantities, and much stress has been laid on the long continued stirring. In order to meet the case more fully, I have made my experiments on very small quantities, and will now detail one of the series.

The acid employed was colorless, and of sp. gr. 1.41 containing by Dr. Ure's tables about 73 per cent. of acid of 1.5, and estimating the fluid drachm at 57 grains,* we have the following construction of the formula, $11 \times 57 \times 1.5 = 940$ weight of 11 fluid drachms of standard acid, $940 \times \frac{100}{73} \div 8 = 160$ grains of acid of 1.41 to a drachm of mercury.

One drachm of mercury was accordingly dissolved without additional heat, in 160 grains of acid as above; the solution was then added to 6 drachms of lard and 4 fluid drachms of olive oil (the proportions of the college) previously melted together in a water bath, and heated to about 190°; a brisk effervescence took place; it was kept in the water bath about fifteen minutes, when it assumed the proper color, and slightly boiled over; it was then taken out, and the stirring continued for about ten minutes, and then left until the next morning, when it was slightly stirred. A specimen of this I have the pleasure to submit to the Society; it has been made about three weeks.

* Fifty-seven grains is the weight of a fluid drachm, old measure, but in the imperial scale it is reduced, I find, to 54.7.

In one experiment with a less proportion of acid, and in which the heat had been carried too far, so as to produce a greenish color, the proper yellow was restored on adding a few drops more of the acid, by which the nature of the change appears to be indicated.

From these experiments and observations, it is evident that it is not indispensable to operate on large quantities in order to obtain a good article; and that a long continued stirring is not required: a careful regulation of the temperature, with attention to the strength of the acid employed, are the points of chief importance. We are also confirmed in the belief that the proportions ordered by the college, are fully adequate to the purpose, if acid of standard strength be employed, or an equivalent quantity if of inferior density.

Before concluding these remarks, I will quote the directions of Dr. Duncan, before alluded to, which have but recently attracted my observation, seeming, as they do, to embody the principles which I have recognized. "Dissolve the mercury in the acid, and pour the solution, while still hot, into the lard, melted in the oil, and also still hot, and mix in a vessel capable of containing five times the quantity, as a violent effervescence takes place. If it should not froth up, the action must be assisted by heat." This process, we are informed, is originally that of Mr. Duncan, of Edinburgh, and yields the most perfect citrine ointment, preserving a fine golden color, and the requisite softness.

Lond. Pharm. Trans. Sept. 1, 1841.

ART. IX.—ON WHITE LEAD By JAMES C. BOOTH.

THE large quantities of white lead employed as a pigment by our painters, the number of patents which have been issued abroad, proving its extensive employment, the large amount of capital invested in its manufacture, bespeak a material of no ordinary importance, and lead us to inquire whether the processes by which it is produced may not be improved relatively to economy and convenience. Undoubtedly one method by which this end may be attained is by a thorough knowledge of the chemical principles which are involved in its production, ere we can take a higher step in the application of chemistry to its improvement; and it is to this point the following remarks will be directed, by investigating the theory of the processes which are now pursued.

There are three principal modifications of the processes for producing white lead, which will include all the patents that have been granted, subject of course to such variations as secure the privileges of numerous patentees. They are those in which the formation of white lead is in whole, or in part, induced by atmospheric agency, those operating by single, and lastly those by double elective affinity.

I. *Triturating Processes.*—1. The earliest account which I have been enabled to procure of the manufacture of white lead by the action of atmospheric agents alone, or in chief part, will be found in this Journal, vol. i, 3d series, p. 158, from which it appears that G. F. Hagner obtained a patent for such a process in 1817. Finely granulated metallic lead was made to revolve in cylinders with water and a portion of vinegar, the air having access; by which means it was converted into a white substance, a mixture of carbonate and hydrate, as we shall find below. When used as a pigment, this white lead was very liable to become yellow, in consequence of which the process was so varied as to fall more evidently under those dependant on single elective affinity. The manu-

facturers performed upwards of two thousand experiments in the course of five years, and produced an article of such a quality that in 1826 they obtained a premium for it from the Franklin Institute.

2. In 1818, J. Richards obtained a patent for a process on similar principles, excepting that he appears to have employed only lead, air and water, (Jour. Frank. Inst., vol. xxvi, pp. 125, 175.) The white lead was deficient in color and body, as may be seen in the Technical Collection of the Franklin Institute.

3. In the Lond. Jour. of Arts and Science, vol. v., 1835, may be found a patent of Torassa, Muston and Wood, in which granulated lead was shaken in a moistened state on trays and the comminuted gray mass exposed to the air until a white lead was formed. From the date of the patent, 1833, it is very possible that the first ideas of the process were derived From G. F. Hagner, while the latter was in England in 1817–18, (Jour. Frank. Inst., vol. i., 3d series, p. 159.) "It is said that upwards of £100,000 have been expended at Chelsea, by a joint stock company, for executing this most operose and defective process." (Ure's Dict., p. 1300.)

4. Notwithstanding the ill success of these processes, we find another patent, (Jour. Frank. Inst., vol. xxvi., p. 119,) taken out by Homer Holland, in which the same mode of making the white oxide, &c., is claimed by the patentee, excepting that to make the carbonate, he introduces a portion of carbonate of soda into the water. In an amended patent (1838) he claims the use of any alcaline salt or substitute, whose elements consist of oxygen, carbon and hydrogen instead of alcaline carbonates.

5. The Jour. Frank. Inst., vol. xxvi., p. 123, presents another patent by Smith Gardner for making white lead by attrition, with this variation, that the operation is conducted in close vessels into which carbonic acid and air are driven during the attrition, thereby presenting them, says the patentee, "to the suboxide of lead in its nascent state." "By

ntroducing a very small portion of vapor of vinegar" with the gases, a superior article is at once obtained perfectly free from color.

Before passing to a consideration of the principles involved in the above processes, we may be allowed to remark, 1st. That by a comparison of the dates of the 2d and 4th patents, it is clear that it would be very advisable for patentees to examine previous patents on the same subject, before they lay open their patent to legal attacks and flaws. 2d. That by comparing the 3d patent with the first two, it is evident that a vast amount of capital might be saved by first ascertaining what results others have obtained before we enter the same field of research. 3d. That the 4th patent shows that to give a clear scientific view of a chemical process, something more is requisite than a superficial knowledge of the science, for in the patentee's first project, he calls the compound produced by attrition of lead a suboxide, and in the amended project he is constrained "to disclaim the opinion, that plumbic pulp, under any circumstances, can be considered a definite compound, and much less an oxide; but that it is a compound of lead, into which the elements, hydrogen, carbon and nitrogen enter, as well as oxygen." Neither of these views being correct, it would have been better to have avoided such theoretic expressions altogether.

Bonsdorf* exposed a clear surface of lead to moist air, which soon coated it with suboxide. A similar piece of lead, laid in pure water containing air, soon began to form a cloud of hydrated oxide of lead which dissolved in the water. The smallest quantity of foreign matter, particularly of a saline nature, except nitrates, prevents this action; and so delicate is the test that Bonsdorf thinks it may be employed to try the purity of water, by throwing filings of metallic lead on the surface and observing a few minutes whether the small cloud of hydrate appears; which only occurs when the water is pure. This fact shows why the first project of the fourth patent could not be successful, by introducing a carbonated

*Berzelius Jahresbericht, 1837.

alcali into the water in which metallic lead was triturated to form an oxide, and from that a carbonate, even if there were no other grounds to repudiate such a process. So far from accelerating, it must have retarded the operation.

Bonsdorf found still farther, that if, instead of permitting the lead to form a hydrate by resting in the water, it were put into a flask and the latter closed up and shaken, suboxide alone formed on the surface. He explains the fact on the theory, that when the lead is at rest, electric currents are formed between the metal and its oxidized points, which determine a higher oxidation, even as far as red lead, according to his observations, while, by shaking, the currents are disturbed, and the whole surface of the lead becomes suboxidized, which prevents further oxidation even if left at rest. Hence it follows, that the lead must first be uniformly suboxidized by trituration, and as it passes into a higher state of oxidation takes up water and carbonic acid, but in the third patent a portion of the oxide and carbonate evidently formed after exposure to the atmosphere. It is probable that in all such cases where carbonic acid is not artificially used, a certain quantity of that acid will be absorbed by the oxides upon exposure to the air subsequent to attrition. The comminuted lead, when taken from the trays, where lead was only moistened, has the dark gray color of suboxide, and first assumes its white appearance by exposure to the atmosphere.

The same chemist exposed a lead plate to moist air until the whole surface was suboxidized, then removed it from a portion of the surface and covered this with water, at which place a vegetation was formed, which he found to consist of one atom of carbonate, and one atom of hydrate of lead. It is therefore a simple hydrocarbonate of lead. This is, in all probability, the substance that is formed in the first four patents, where carbonic acid was not artificially introduced; for where the quantity of this acid is as small as that contained in the atmosphere, and, where the tendency of the lead is also to form a hydrate, it is not probable that this acid should in

its very diffused state usurp the place of much of the hydrate.

When vinegar is introduced in these processes, another operation takes place, which induces the more rapid formation of an oxide of lead, preventing at the same time the formation of as much hydrate, and the acetate which forms being simultaneously decomposed by carbonic acid, the vinegar as rapidly passes to another portion of oxide.

In Bonsdorf's experiments the hydrocarbonate was tried as a pigment and found to possess little body, a circumstance which will probably hold good with nearly all white lead made by the above processes, excepting the last, and the modified operations of the first patent. In the fifth patent carbonic acid is forced in with atmospheric air, and probably acts in part catalytically by inducing the formation of oxide, and in part by uniting with the oxide "in its nascent state," and thereby preventing the formation of as large a quantity of hydrate. It is said, moreover, that the white lead thus obtained is equal to that manufactured by the older processes, (Jour. Frank. Inst., vol. xxvi., p. 125,) but I question whether it will be found to contain the requisite quantity of carbonic acid to prevent its liability to become yellow. It remains to be seen, however, whether by any one of these processes, in which trituration of metallic lead is the chief point, the mingled hydrate and carbonate of lead contains a sufficient amount of carbonate to prevent its becoming yellow by employment as a pigment; for that was the chief difficulty experienced by the first patent, and probably will be an objection to all the others; and it will be shown below that the more highly carbonated the lead is, the less it is subject to this change. The economy of the process of attrition certainly demands attention, as well as the simple arrangements by which it may be effected, but then the question returns, whether the tendency to become yellow by exposure to the atmosphere, or of vapors, can be obviated by giving the highest dose of carbonic acid, partly by driving that gas through the apparatus, and partly by introducing another ingredient into the water em-

ployed. If this point be attained, the question may again be asked whether body can be given to the compound, and whether it can be thus made destitute of a crystalline structure, for in the experiments of Bonsdorf, given above, the vegetation evinced a strong tendency to crystallization, and it appears that the same objection is generally urged against white lead made by attrition, viz.: it is deficient in body.

If the theory advanced in the fifth patent (Jour. Frank. Inst., vol. xxvi, p. 123,) be correct, that the white lead formed by attrition, where carbonic acid is presented to oxide of lead in its nascent state, is possessed of a body and of a good color, then we may hope that the process of attrition may yet be productive of good results. It should not be forgotten, however, that in all these processes carbonic acid is really present and in considerable quantity, if we suppose a large amount of air to pass over the agitated lead, but then the quantity relatively to the oxygen of the atmosphere is very small. I would suggest whether it would not be desirable to perform an experiment in a similar manner to the above, in which water may be omitted and due proportions of air and carbonic acid driven through an agitated apparatus containing simply moistened lead, either without, or, perhaps, better with the aid of steam, or at a higher than the ordinary atmospheric temperatures.

II. *Processes more or less dependent on Single Elective Affinity.*—These processes all depend upon the decomposition of a subsalt of lead by carbonic acid. 1. Thènard made the first suggestion relative to the principle, and MM. Brechoz and Leseur, who arranged the contrivances for conducting the process, received a prize for their white lead. Neutral acetate of lead was digested with litharge forming a soluble subacetate, through which, diluted with water, was passed a stream of carbonic acid. Carbonate of lead precipitated, and there remained a neutral acetate in solution, which being redigested with litharge, again formed a subsalt, and was again precipitated as before. Thus the acetate of lead first employed was constantly used in the operation, a small

portion of new material being added each time to allow for accidental loss and waste. All subsequent patents based on a similar principle were derived from the above patent, which was carried out on a large scale by MM. Roard and Brechoz. At this day a large portion of white lead used in France and Sweden is similarly manufactured, and the process is also employed in Germany, England, and at one establishment in this country, in Brooklyn, New York. It is generally believed that the old processes for manufacturing white lead by using fermenting tan, &c., and that in which vinegar, air and carbonic acid are driven into chambers containing lead and vinegar, are governed by different principles, but it will be shown that they are essentially the same with those where carbonic acid is passed through a subsalt of lead.

A. Precipitating Processes.—2. It was stated that G. F. Hagner obtained a patent in 1817 for manufacturing white lead by attrition, but that the quality of the material being inferior, the proprietors varied the apparatus and process in such a manner as to approach Thènard's method. For a more minute description of their plan, see Jour. Frank. Inst., vol. i., 3d series, p. 158. They forced carbonic acid through a mixture of litharge, pulpy oxide produced by attrition, and vinegar, and their white lead was of such a quality as to receive a medal in 1826.

3. Button and Dyar took out a patent for making white lead, the specification of which will be found in Rep. Pat. Inv., vol, x., 1838, with a drawing illustrating the apparatus. They employed purified carbonic acid from the combustion of coke, which was passed through a mixture of litharge and nitrate of lead dissolved and suspended in water, and kept at the boiling point of water in the state of agitation by the issue of steam in the bottom of the decomposing vats. The carbonate as it is formed was drawn up by a pump, suspended in water, and falling on a filter, where it remained, suffered the liquid to fall through into the first vat.

4. In the Jour. Frank. Inst., vol. xxv., p. 197, are remarks on the manufacture of white lead by Mr. Benson, who is

probably the same one engaged with Mr. Gossage in the manufacture, near Birmingham, England. According to their patent, they employ of vinegar $\frac{1}{300}$ of the weight of litharge, and add so much moisture to the latter that it merely "feels sensibly damp to the touch." Heated carbonic acid (from coke) is passed over this mixture in stone troughs, while the contents are powerfully stirred up, (Ure's Dict.)

5. Cory's patent in Rep. Pat. Inv., vol. xii., 1839, employs carbonic acid derived from a lime-kiln, introducing it into a chamber, the upper part or ceiling of which is perforated with numerous small holes. A solution of subacetate of lead is pumped up to the roof of the chamber and falls through the small holes like a shower, absorbing carbonic acid in its descent.

These are the principal variations in the precipitating method of Thènard; all are referable to the same theory, viz., the decomposition of a subsalt of lead by carbonic acid. The last is evidently the same, excepting that the operation is inverted, and instead of passing carbonic acid through the solution, the latter drops through an atmosphere of the acid. The second is somewhat analogous to the fourth patent, excepting that the latter prescribes less moisture and employs heated carbonic acid. In both, the acid operates by forming carbonate of lead from a part of the oxide in the basic acetate, while the latter, becoming more neutral, is acted upon by the excess of litharge, forming again the basic acetate, which is again decomposed. The third patent employs a basic nitrate of lead, i. e. nitrate of lead and litharge, instead of an acetate, which, together with the boiling state of the solution, constitutes its difference from the others.

According to the observations of Robiquet, Pfaff, and others, the carbonate of lead obtained by precipitation with carbonic acid is a neutral salt, consisting of one atom each of acid and base, the only water present being hygroscopic. In the Bullet. d. Sciences, &c. en Neerlande, vol. i., p. 302, Mulder has shown that the white leads of commerce consist of

two atoms of carbonate of lead and one atom of hydrate, but I do not know whether he experimented on white lead precipitated by carbonic acid among the rest; the probability is that he did, for the process is evidently similar to the older method, in which a fermenting material is employed.

The carbonate of lead formed by these processes, whether similar or not in composition to the ordinary kinds, differs in one essential point, that it will not cover as well, and has less body; and Dr. Ure appears to have first pointed out the cause of this defect; for on examining it microscopically, he found it to consist of small crystalline particles, with a certain degree of translucency. White lead produced by the older methods is superior to it in these respects, which Mr. Benson, and I think justly, refers to "its never having departed from the solid state," and that the particles "have not been at liberty to arrange themselves symmetrically." In his patent, therefore, (fourth) he employs a quantity of moisture just sufficient to determine the action of the carbonic acid. It is said that Messrs. Gossage and Benson produce forty tons of excellent white lead per week, (Ure's Dict.) La Societé d' Encouragement made a large number of experiments on the various kinds of white lead, and came to the conclusion that that produced by precipitation will cover as well as the others, but requires more coatings, that it has a degree of translucency, but that it is whiter than that made by the older processes." (Dict. de l' Industrie, &c., tome iii., p. 164.) It may be that this defect of body may be remedied by violent agitation during the process of precipitation, which would disturb the crystallization. If so, the third patent should produce a dense material, and it is probable that the violent stirring in the fourth may have this effect in addition to its exposing a greater surface to the action of the carbonic acid. We shall dismiss the fifth patent with the remark that the extent of apparatus required is decidedly objectionable, and that it is inefficient, since the liquid must be pumped up several times,

and suffered to fall in showers before the decomposition is sufficiently effected.

There are several points deserving of notice, relative to this mode of manufacturing white lead. The quantity of litharge obtained in different processes of the arts is greater than the commercial demand for it, and as a reconversion of it into metallic lead is attended with a loss of more than one-sixteenth of its weight, it is desirable to find purposes to which it may be directly applied, unattended with loss. These processes for making white lead are of such a character, and hence, if the best quality of white lead cannot now be made by them, it is worth devoting time to their improvement. But, again, there is a much greater nicety in conducting these operations over the old methods, and there may be introduced into them a greater certainty in regard to the amounts of the several materials employed, circumstances which certainly impart some value to them considered with reference to the health and cleanliness of operatives, and to economy to the manufacturer. Of all the processes given above I should be inclined to prefer that of the fourth patent, as being most likely on theoretic grounds to produce the best result. Before closing this portion of our subject, we must make reference to the manufactory in Brooklyn, New York, the only one in this country, as far as my information extends, where Thènard's principle is successfully pursued. The sample of white lead from this establishment, offered at the exhibition of the Franklin Institute last fall, was considered to be about equal to the others, and spoke well for the method, if it was made on this principle, for I understand they pursue both the older and the precipitating processes.

B. Older processes.—Among these we include the old Dutch method, where a fermenting material was employed, and that which substitutes a heated chamber for the fermenting beds. The oldest among these is probably that which originated in Holland, where rolled sheet lead is placed in earthen pots containing a small quantity of vinegar in the bottom, and these pots then buried in dung, which, by its fer-

mentation, produces both heat, steam, and carbonic acid. This method being that which is chiefly pursued in this country, we shall not enter into technical details respecting it. The English substitute fermenting tan for dung, otherwise the process is the same. The Kremser white is produced by a variation of the same process. It is conducted in different parts of Austria, particularly at Klagenfurth, in Carinthia, and the lead, which is very pure, is obtained from Bleiberg, in Carinthia. Sheets of lead are hung in small wooden troughs, in the bottom of which is poured mixtures, varying in different establishments, sometimes equal parts of wine lees and vinegar, &c. The troughs, to the number of ninety, more or less, are placed in a chamber, each one closed up, and the whole chamber heated by a furnace to about the temperature of 100° Fahrenheit. If the heat be too high, carbonic acid escapes, and less white lead is the result. It is generally conceded by the best judges that the best Carinthian white lead is superior to all other kinds.

Now, if we suppose that twenty-three out of twenty-four hundred weight of lead are converted into white lead, then for these twenty-three hundred weight may be employed nearly 1300 lb. of vinegar, of such a strength that it would convert 128 lbs. of lead into neutral acetate. It is true that in different establishments the relative quantities of vinegar and lead vary, but still the variation is an immaterial point, for the former is rarely more than the fractional part of the lead employed; thus a pint, or a half pint of comparatively weak acid is used to three pounds of lead. It is, therefore, clearly evident that the former theory, that vinegar both yielded oxygen and carbonic acid, or either one, to form white lead, is either wholly without foundation, or else its service in this respect would produce but a very small part of the white lead which is actually obtained; or suppose that a bed of 6,000 pots, of ten tier, and 600 in a tier, or layer, contained one pint of vinegar, and three pounds of lead in each, and that the pint of acid contained one ounce of *dry* acetic acid; the whole bed would then contain 18,000 lbs. of

lead, and 6,000 oz. of dry acid. But this acid would consist of 2852.4 carbon, 2798.4 oxygen, and 349.2 hydrogen in ounces. Then the 2852.4 oz. of carbon, if converted into carbonic acid, would take up 3,015 lbs. of lead to form a carbonate, or about one-sixth of the metal contained in the bed, while the above amount of oxygen would only take up 2,268 lbs. of lead to make an oxide, or one-eighth of the amount of metal which is present. It follows clearly that the acetic acid is neither employed to yield oxygen for oxidizing, nor carbon for producing a carbonate, to any appreciable extent, and, moreover, it should not be forgotten that a much smaller quantity of vinegar will suffice to produce a carbonate than is specified above. The chief products arising from the fermentation of dung are carbonic acid, carbonate of ammonia and water, the second of which may be omitted, as it arises in small quantity from tan, which is employed with success in England. The heat of fermentation then will raise vapour of vinegar, carbonic acid and water; but there is another material of value present in this process, the atmosphere, notwithstanding experiments made in Europe,* which seemed to show that its presence deteriorated the color of the white lead; for in all the ordinary processes it must be present, and in those which follow it has been shown by direct experiment to be essential to the formation of oxide. The moisture which is present appears to act chiefly by determining the action of the other substances, and not to be decomposed, for we have no evidence of its decomposition, and the changes which ensue to the lead can be satisfactorily explained without it. It may, however, be maintained that it assists in forming oxide, but in the subsequent experiments, air being found necessary, proves that the chief use of the latter is to oxidize the lead. We have shown above that in Bonsdorf's experiments the lead will oxidize in a moist atmosphere, and that the presence of carbonic acid tends to hasten the operation, with the production of a carbonate; acetic acid, then, by its more energetic action, will surely produce an acetate, and where its

* Berzelius' Elements of Chemistry.

quantity is small, this will be a subsalt. But there is carbonic acid also present, and the material must be moist enough to determine its action in decomposing the acetate; while the acetic acid, thus slowly disengaged, will act similarly on another portion of the metal, or its oxide. To this it may be objected, that at length there will be a neutral salt formed, which the carbonic acid cannot decompose. It is, however, shown that this acid will decompose even the neutral salt to a certain extent, when it is in solution. It is not, however, necessary to suppose this, for during the length of time required for the conversion of the lead, the whole of the vinegar might be evaporated without its being noticed by its odour above the bed to any appreciable extent, and as each successive portion of acetate is decomposed, a portion of the acid may thus be volatilized and escape into the atmosphere. Another explanation of this presently appeals. That acetate of lead is thus formed is shown from the amount of it lost upon washing white lead, which is so great that it becomes a question with the manufacturer whether it might not be re-extracted as acetate, or better in some other form. It may be farther objected that if carbonic acid is thus employed to decompose the generating acetate, why will it not do it, when a piece of the lead in a pot dips into the acid, for in this case only acetate is the result. To this may be answered that from the known superior energy of the acetic acid, it forms an acetate with great rapidity, the small crystals of it below acting with capillarity to convey the acid to the upper portions of the metallic coil, while the slowly disengaged carbonic acid can affect the merely moistened crystalline mass with difficulty, and certainly not materially, excepting on its surface. The conclusion, then, is that the process is substantially the same as in Thènard's method, after the lead is oxidized by a moist atmosphere, viz., that a sub-acetate is formed which is simultaneously decomposed by carbonic acid, and that the more neutral salt thus generated being again rendered basic by another portion of oxide is again decomposed, while the final formation of an acid salt is prevented by the

gradual escape of a portion of the vinegar. We are not, however, left in doubt as to the latter point, for it has been found that a peculiar etherial substance is obtained during the process, called *acetone*, which may be obtained by passing acetic acid through a heated glass tube, or by the dry distillation of an acetate. It is composed, according to the views of the best chemists, of 3 vol. carbon + 6 vol. hydrogen + 1 vol. oxygen, and its origin from acetic acid may be thus expressed,

1 atom acetic acid, - - -	$4\,C + 6\,H + 3\,O$
Subtract 1 atom carbonic acid, -	$C \quad + 2\,O$
There remains 1 atom of acetone,	$3\,C + 6\,H + 1\,O$

So that acetic acid is resolved into acetone and carbonic acid. By heating the neutral dry acetate of lead, it fuses and evolves carbonic acid and acetone to a given point, when it congeals and forms a basic (two-thirds,) acetate, which requires a higher temperature for its decomposition. One-third of the acetic acid in the neutral salt is thus decomposed, and there remains a basic salt.* Now if the above given explanation of the formation of carbonate of lead be correct, then from the middle, towards the close of the process, when a neutral salt will be forming, the constant presence of a considerable amount of heat will tend to form acetone and carbonic acid, the former of which escapes into the atmosphere, while the latter assists in decomposing the basic acetate which remains. The latter is thus re-resolved into a neutral salt to be again subjected to the same decomposition as before. It might be supposed that this theory would account for the formation of all the carbonate of lead, but it has been shown above that the quantity of vinegar is too small as compared with the metallic lead, and from the relative amount of the two, the conversion of the greater part of the lead into its carbonic must be explained on Thènard's principle.

These views of the author were first cursorily expressed in

* Wöhler in Berzelius' Chemistry, vol. viii., p. 698.

a report by the Franklin Institute, (Journal for 1839,) and I find that the same views are held by Mitscherlich, in vol. ii., of his Elements, Berlin, 1840. Benson alludes to a similar view, (Jour. Frank. Inst., vol. xxv., p. 197,) but refers it chiefly to his process, (see above.) I have given my opinions more at large on this subject, since some of the most eminent chemists have advanced the opinion, and I believe it is generally held, that the formation of carbonate of lead by the old process depended mainly on the decomposition of acetic acid.

C. Newer processes.—I have understood that experiments were performed many years since, with the view of making white lead, by the introduction of vapour of vinegar, air, and carbonic acid, into heated apartments containing lead, but as I am unable to find the authority for this, I shall pass to those with which I am acquainted.

Mr. E. Clark took out a patent in 1828 for a process for making white lead in close chambers, heated by steam, into which he introduced carbonic acid and air, the vinegar being in a trough, and running through the chamber, and heated by steam passing through its double bottom, (Jour. Frank. Inst., vol. xxv., p. 232.) Richard's patent was taken out subsequently, and differed in the introduction of steam into the chamber, besides some minor differences of arrangement. I should suppose that the vapourized vinegar would afford sufficient steam, as in the first patent, the object being merely to ensure the action of the other materials.

It will be observed that the process, chemically speaking, is the same in these patents as in Thènard's method, or the older processes, viz., that an oxide and acetate are formed and decomposed by carbonic acid.

The carbonate formed by the above processes, the older and newer, is composed of two atoms of carbonate, and one of hydrate of lead, but the difference between them and Thènard's lies in the crystalline granular state of the latter, while in the former " the lead has not departed from the solid state," and is therefore more compact or amorphous, and has greater body.

A portion of white lead manufactured according to Clark's process was exhibited at the Franklin Institute last Fall, and pronounced equal to the others, it not being known at the time that it was thus manufactured. A sample of Richards' is in the Technical Cabinet of the Franklin Institute.

The main question relative to the newer processes touches their economy, a point which we do not propose to discuss, as foreign to the nature of this essay. Certainly they offer greater neatness of arrangement, and avoid the heavy losses from breakage of pots, while the materials employed are economical, but then again they require their peculiar expenditure for the production of carbonic acid and steam.

III. Processes dependent on double elective affinity.—The principle of these processes is not novel, although various patents have been taken out latterly based upon it, depending on the precipitation of a salt of lead by a carbonated alkali. Some are simple, others of a very complicated character, as the following selections will show.

Hemming's Lond. Jour., vol. xii. Nitrate of soda is decomposed by sulphuric acid, by which nitric acid is obtained, and sulphate of soda. The sulphate of soda is decomposed by charcoal, chalk, &c., and a carbonate of soda produced. The nitric acid first obtained is employed to form a nitrate with lead or its oxide, and this in solution is precipitated by the carbonate of soda. Thus we have obtained a carbonate of lead and nitrate of soda, the latter of which is again decomposed as above. To say the least of it, the process is highly ingenious, and involves not a little chemical knowledge, while, like Thènard's process, the original salt is recovered, except an allowance for accidental waste.

Watt & Tebbutt's patent, Lond. Jour., vol. xiii. Chloride of sodium (common salt) and litharge are heated to make chloride of lead. Three parts of the latter are mingled with one of red lead, and sulphuric acid added, while steam heat is applied. There remains sulphate of lead, and chlorine is evolved. The sulphate is then treated with carbonated alkali, which, according to the patent, will make hydrate with a little

carbonate of lead, through which carbonic acid is passed to fully carbonate it. The chloride of lead is also treated with nitric acid, and carbonated in a similar manner. Farther, lead is dissolved in nitric acid, and precipitated by a caustic alkali, or earth. This patent is evidently complicated, perhaps too much so for practical purposes, and unless the patentee employs a mixture of carbonated with caustic alkali, I do not know how he is to obtain a hydrate with a little carbonate; I would rather reverse it, and say carbonate with a little hydrate. By employing red lead with the chloride, the metal is oxidized by it, so that chlorine, and not hydrochloric acid, is the result; but why should the evolution of chlorine be conneeted with a white lead establishment?

Leigh's patent, Rep. Pat. Inv., vol. xiv., 1840, employs first, nitric acid to act on galena, to obtain a nitrate of lead; 2d, carbonate of ammonia purified from gas liquor, or from the distillation of organic substances; 3d, decomposes the nitrate by this carbonate, obtaining carbonate of lead and nitrate of ammonia; 4th, decomposes the sulphate, or chloride, of lead by carbonate of ammonia. In consequence of the amount of litharge produced collaterally in several branches of art, the action of nitric acid on galena appears to be no improvement, particularly as a portion of the acid is decomposed and lost by yielding oxygen to the lead to form the whole of the oxide. If the carbonate of ammonia can be obtained at a cheaper rate than those of soda, or potassa, and of a suffi ient degree of purity, the process might be a good one, but this may be questioned, and even if a sulphate or a muriate of ammonia, be obtained, for which there is a ready sale, I question whether the process would then be economial.

It is not necessary to enumerate more of these highly chemical processes, for it must be evident to any one acquainted with the present state of chemical science, that they might be varied "ad infinitum." The main questions are the economy of the processes and the quality of the material produced. In reference to the former point, I would merely remark that I doubt much whether such processes can be successful,

where the only object is the manufacture of white lead; they ought to be connected with other chemical manufactures, the various processes of which should be "dovetailed" into each other, so that collaterial products may be wrought up to other products of great utility in the arts. I have not yet seen a good analysis of white lead made by these chemical processes, but from my own experiments I believe it will prove to be like the others, a mixture of hydrate and carbonate, for upon precipitating concentrated solutions of carbonate of soda and acetate of lead, carbonic acid is uniformly generated, and escapes with slight effervescence. With a pure basic acetate this does not take place, because the carbonic acid which would have escaped unites with the soda. The decompositions may be thus illustrated.

Carbonate of soda,	$C\,O^2$	Carbonic acid.
	$2C\,O^2$	Basic carbonate of lead.
	$3Na\,O$	Acetate of soda.
Neutr, acet. of lead.	$3\bar{A}$	Acetate of soda.
	$3Pb\,O$	Basic carbonate of lead.
Carbonate of soda,	$C\,O^2$	Acet. and carb. of soda.
	$2C\,O^2$	Basic carb. of lead.
	$3Na\,O$	Acet. and carb. of soda.
Basic acet. of lead	$2\bar{A}$	Acet. and carb. of soda.
	$3Pb\,O$	Basic carb. of lead.

So that in either case a basic carbonate of lead results, the excess of oxide uniting with a proportion of water to form a hydrate. It would, therefore, appear that the white lead thus produced is similar to that resulting from Thenard's principle, under all its modifications. Whether it forms as good a pigment as that produced by the older processes I cannot determine, having never heard the results of its application.

Conclusion.—Mulder, (before quoted Bullet. d. Sci. &c., in Neerlande I., p. 302,) examined a white lead made by a process lately patented by Stratingh, and found it to consist of three atoms of carbonate, and one of hydrate. This method of manufacture, which I have not seen described, has a decided advantage over others, by its not becoming yellow in a

short a time when employed as a pigment, and Mulder therefore believes that the hydrated oxide is the principal cause of this change of color, as sulphuretted hydrogen affects the carbonate less than the hydrate. That this view is correct is shown from the great tendency to become yellow possessed by the compound containing one atom each of carbonate and hydrate. (See the commencement of this essay.) The ordinary carbonates will absorb a certain quantum more of carbonic acid, but never so much as to expel all the water and form a neutral salt. This curious fact seems to show that there is a stronger affinity between the hydrate and carbonate than between carbonic acid and oxide of lead, to form a neutral salt, and from all the above processes it is evident that there is a superior tendency to form a compound, consisting of two atoms of carbonate and one atom of hydrate.

It appears then from the preceding, that we are acquainted with at least three distinct varieties of white lead.

Hydrotricarbonate,	$(Pb\,O + H\,O) + (Pb\,O + C\,O^2)$
Hydrobicarbonate,	$(Pb\,O + H\,O) + 2\,(Pb\,O + C\,O^2)$
Hydrotricarbonate,	$(Pb\,O + H\,O) + 3\,(Pb + OC\,O^2)$

Journ. Frank. Inst. Jan. 1842.

MISCELLANY.

Toxicology.—Although Toxicology is not numbered among the educational objects of the Pharmaceutical Society, yet a knowledge of the important matter embraced in its consideration, appears to be so necessary to the Pharmaceutical Chemist, that we shall include an occasional notice of it in our pages.

We believe the Council were induced to omit toxicology in the list of subjects upon which the qualification of the Members of the Society should be tested, merely from a fear of appearing to grasp at too much, and trenching in any way upon the peculiar province of the medical practitioner. But, while we fully appreciate these motives, we still continue of the opinion we have always entertained, that a practical acquaintance with the properties and modes of operation of poisons, together with their proper antidotes and means of detection, are legitimate and essential acquirements for the fully qualified Pharmaceutical Chemist.

As a retailer of drugs, it is important that he should possess a well grounded knowledge of the properties of those substances, which exercise a destructive influence upon human life. Almost all the substances of this description under the name of Poisons, which pass into the hands of the public, do so through the medium of the retail Chemist, and he is held accountable for the exercise of due caution in supplying them. It is evident, therefore, that he ought to be intimately acquainted with the properties of these bodies; for upon such an acquaintance only can judicious precautions be founded.

In considering the position of the dispenser of medicines in relation to the physician and to the patient, the importance of his being able to detect any accidental error in a prescription, and thus to prevent the evil consequeuces that might otherwise result, is doubted by none. In order to perform this duty, he must be acquainted with Toxicology; he is, in most cases, ignorant of the particular symptoms of the disease, to which the remedy is directed; he presumes not to form a judgment as to what, within the limits of Therapeutics, should be the dose administered, but the moment the intended remedy outsteps these limits, it becomes his province, and indeed his especial duty, to consider the probable effect, and by referring to the prescriber to prevent the occurrence of injury.

The public advantage and safety then require a knowledge of Toxicology in the Pharmaceutical Chemist, which knowledge would not imply any departure from his legitimate province.

The medical treatment of cases of poisoning, as well as those of suspended animation from drowning and other causes, belongs undoubtedly to the medical practitioner; but as in the one case no less than in the other, the success of any remedial means depends in a great measure upon the promptness with which they are adopted, it is perfectly justifiable, in the absence of a medical man, *for others possessing the requisite knowledge to act until medical advice is obtained.* In the case of poisoning, the public, under such circumstances, naturally look to the Chemist, from his presumed acquaintance with the properties of drugs, and his knowledge of Chemistry, which science must regulate the treatment; and it is consistent and proper that he should be enabled to administer an antidote on such an emergency, as that persons possessing no medical qualification should, in the other case, be armed with the means of restoring suspended animation.

Beyond this we should, of course, deprecate the interference of the Chemist in the medical treatment of cases of poisoning. He will frequently, however, be enabled to render efficient assistance to the Physician or Surgeon, in determining the nature of the poisonous substance present, and as it seems desirable in these cases to bring as great an amount as possible of chemical as well as medical knowledge to bear upon them, the joint labor of the two may often be more successfully bestowed than either separately.

But there is yet another branch of Toxicology, no less important than those already adverted to, and having especial relation to the fulfilment of the ends of justice. We mean the detection of poison in the subject after death. Deep, indeed, is the responsibility which those incur who, in cases where other evidence is doubtful or wholly wanting, undertake the duty of determining the cause of death, and thereby perhaps fixing upon a fellow-being the stigma of guilt, for which his life will be sacrificed. There are few, it is presumed, who would not gladly shrink from so erroneous a task, yet the welfare of society demands that it should be performed, and performed by those whose education, experience, and general knowledge, shall enable them most efficiently to execute it.

The detection and determination of poisonous matter is a purely chemical process. It requires an intimate acquaintance with the principles of Chemistry, and a practical experience in the manipulations of the laboratory; in the absence of which, no man, however eminent in other respects, would be competent to undertake so delicate an operation. There are few, indeed, in the present day among us, who, without much previous study, and a lengthened practical ordeal, would presume to embark in this difficult department. Yet we can but consider, that being strictly a branch of chemical science, requiring a practical acquaintance with chemical agents and chemical manipulations, and the devotion of uninterrupt-

ed attention to, perhaps, a searching examination, this branch of Toxicology comes more immediately within the province of the Chemist than of the Medical Practitioner.

These are the views which have induced us to contend for the adoption of Toxicology as a branch of education essential to the Pharmaceutical Chemist; and we yet hope to see it admitted as such by the Council of our Society. We perfectly agree in opinion with those who object to adding to the list of subjects in our educational scheme, any one that is not absolutely required by the circumstances in which we are placed. It is especially, *with reference to these circumstances*, that we are brought to the conclusion we have expressed; and we see nothing in the condition of the medical profession in this country that should deter or prevent our Pharmaceutists from attaining to that eminence in Toxicology which has distinguished those of continental nations.—*Trans. of Pharm. Soc.*

Sulphurous Acid as a Reagent. By A. Duflos.*—Sulphurous acid is employed in analytic Chemistry, as a means of reducing the selenious and telluric acids. M. Wöhler has likewise shown that it converts the arsenic into arsenious acid, and consequently, in the case where we are compelled, during the research for arsenic in organic mixtures, to submit this metal to the action of oxidising substances, it may be useful in reducing the arsenic acid formed, with the view of facilitating the precipitation of the arsenic in the state of sulphuret.

To these analytic applications, we may add another, which does not merit less attention. Suphurous acid is a very valuable auxiliary in the separation and quantitive determination of iodide of copper. When a solution of deutoxide of copper is added to a liquid which contains a solution of iodine in metallic combination, one half of the iodine separates as an insoluble iodide of copper, the other half as free iodine, which remains in solution. This solution may be prevented by using along with the solution of oxide of copper, another of protoxide of iron; this latter then passing to the state of peroxide. This method of separating iodine is certainly very good to obtain it on a large scale, but not when the object is the quantitive determination of the iodine in certain compounds, because the iodide of copper thus formed always contains iron, which renders the result incorrect, and in addition it may happen that the avoidance of the use of iron in the investigation may be especially desired. Sarphati has, it is true, already endeavored to obtain a remedy for this inconvenience, by using, instead of the mixture of the sulphates of iron and copper, a solution of chloride of copper in hydrochloric acid; but, first, this reagent is not always at hand, and is decomposed with great facility; again, it is not a rare circumstance that we desire to deter-

*Ann. der Chem. und Pharm.

mine at the same time, both the quantity of iodine and of chlorine in one and the same liquid: it is therefore indispensable to avoid every addition of chlorine. All these inconveniences are set aside by the use of a solution of sulphate of copper in a concentrated aqueous solution of sulphurous acid. All the iodine existing in the liquid as hydriodate, is then completely precipitated, as an iodide of copper totally insoluble in the liquid which contains free sulphuric acid; while under the same circumstances the chlorine and the bromine does not form an insoluble combination. The iodide of copper is collected on a filter of unsized paper well washed, dried, and finally heated to a temperature of 120° C., in a bath of chloride of calcium, in a small glass tube closed at one end, until it ceases to lose weight. Dividing the weight of the iodide of copper by 1,501, the result will be the quantity of the iodine.—A. G. V.

Journ. de Pharm.

On the Existence of Free Acid in Spiritus Ætheris Nitrosi. By Mr. Harvey.—This spirit, however recently or carefully prepared, contains a portion of free nitrous acid, one effect of which is to decompose various substances, with which the spirit is frequently combined in prescriptions. Thus, if it is ordered in a mixture with iodide of potassium, it will liberate free iodine; if prescribed with mistura ferri composita, it will convert a portion of the proto-carbonate of iron into the inert peroxide; if added to simple infusion of roses, or to a mixture colored with red poppy syrup, it will gradually decolorize it. For mixtures such as the above, I use the Sp. Æth. Nit. deprived of its acid, by being kept standing on crystals of carbonate of potash. If the spirit be of full strength no appreciable quantity of the alkali or nitrate of potash is dissolved, and by the use of the Spiritus Æther Nitrosi so treated, all the objections above described are obviated.

Pharmaceutical Journal and Transactions. Jan. 1842.